

SCIENTIFIC AMERICAN

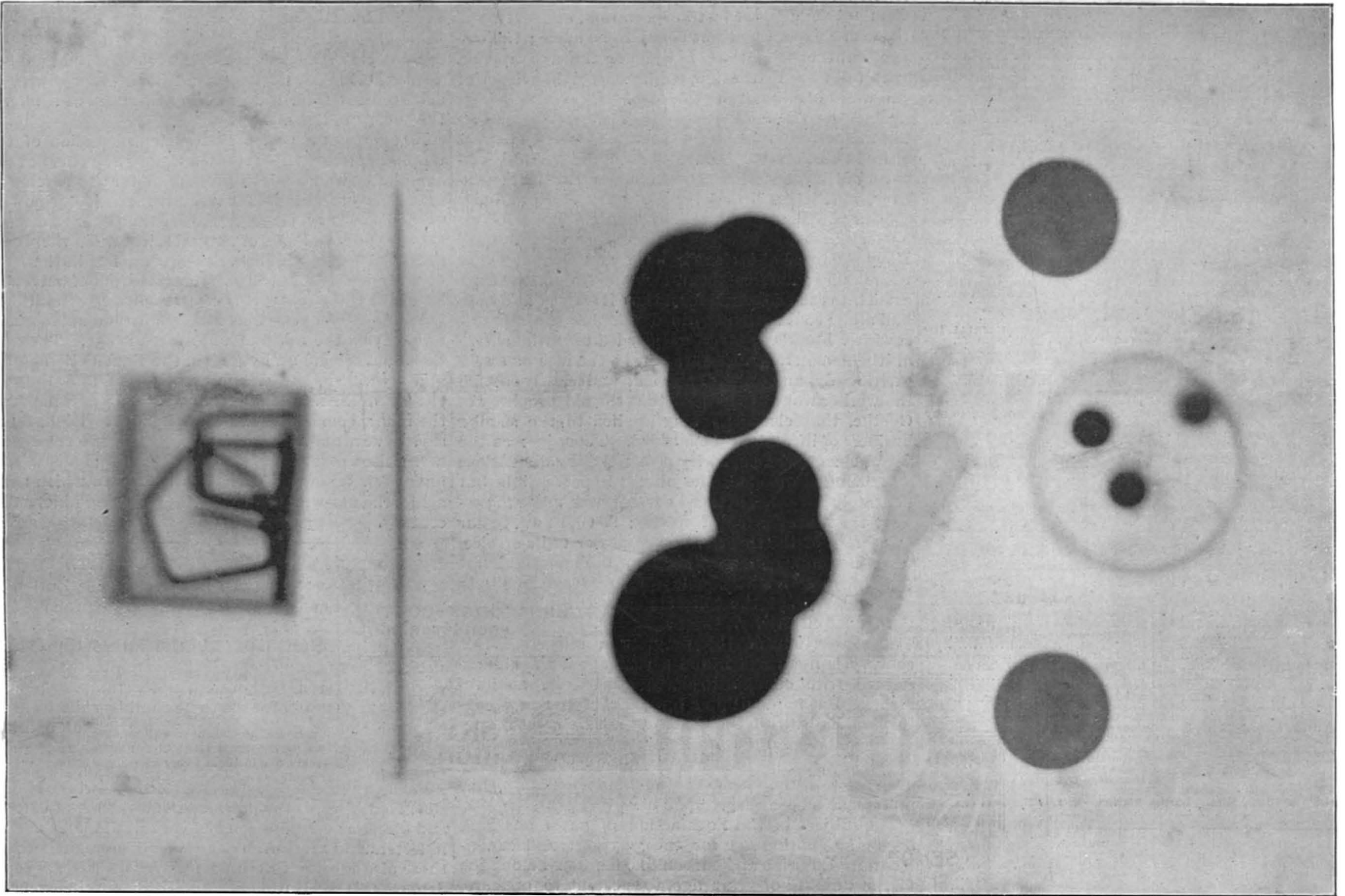
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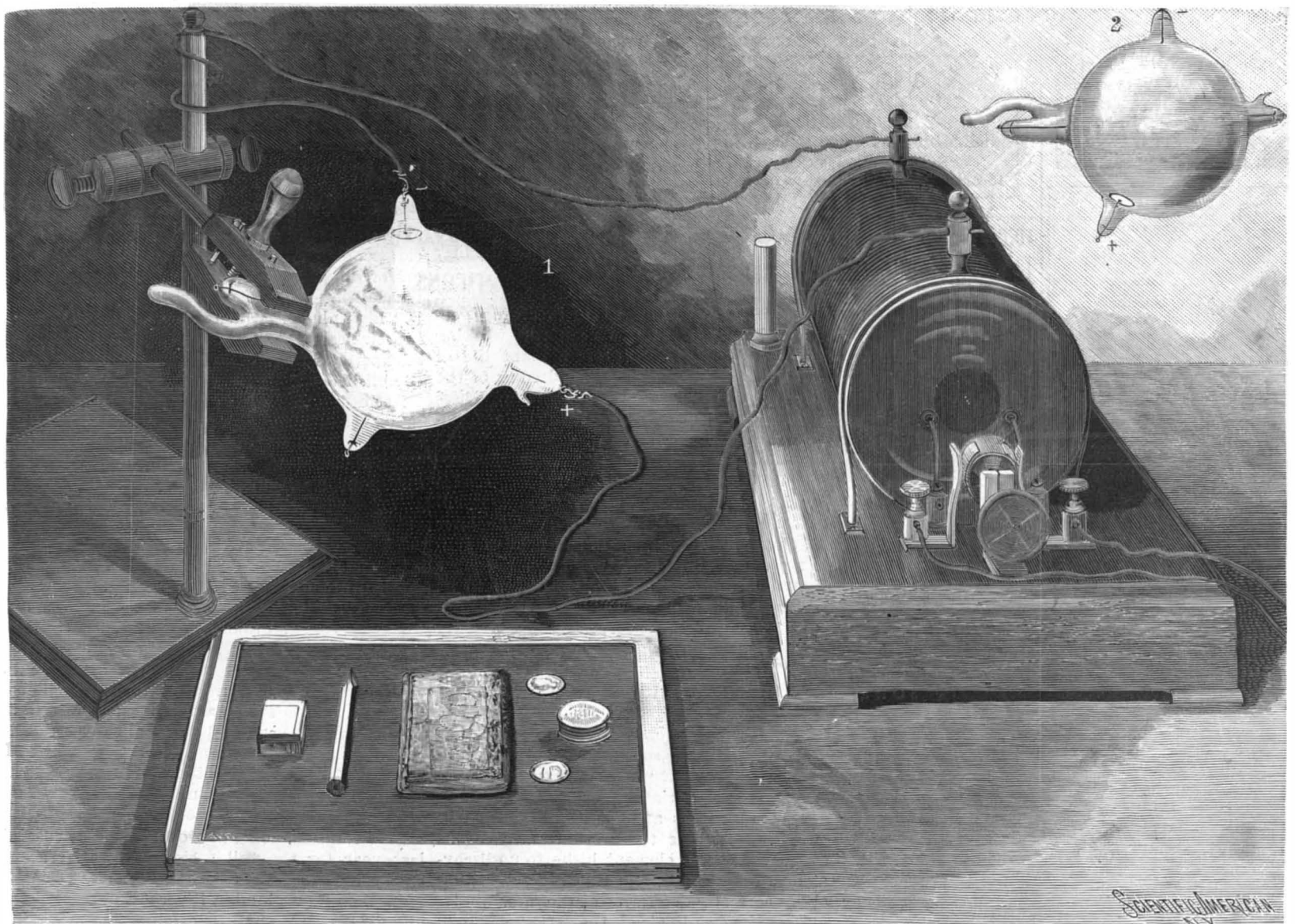
NEW YORK, FEBRUARY 15, 1896

[\$3.00 A YEAR.
WEEKLY.]



Box of aluminum wire weights. Lead pencil, showing lead. Pocketbook containing coins. Coins—Pill box containing metallic spheres.

RAY PHOTOGRAPHS TAKEN BY PROF. A. W. WRIGHT AT YALE UNIVERSITY.



PROF. A. W. WRIGHT'S APPARATUS FOR ROENTGEN PHOTOGRAPHY.—[See page 103.]

Scientific American.

ESTABLISHED 1845.

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THE NEW WORKS OF SCIENCE.

As the proud nineteenth century draws to a close it would seem that its representatives have good reason to be proud of the legacy to be left by them to succeeding ages. The last century saw the infancy of the steam engine, saw the isolation of oxygen gas and of a few other substances in the field of chemistry, and that is nearly all in science given to the present age by its predecessor. Before 1800 the cities of the world were still lighted by lamps and candles; electricity had its highest development in the inefficient frictional electric machines; railroads and steamboats were not yet a factor in transportation, and even the roads of England had but begun to be made; the advantage that there is nothing new under the sun applied with full force to the few achievements in science of the world one hundred years ago.

The nineteenth century commenced. Gas lighting was introduced and the nocturnal crimes of great cities almost ceased. Lavoisier's and Priestley's discovery of oxygen began to bear fruit, and modern chemistry, which is a little over a century old, gradually took a position in the world of science. The galvanic battery gave strong current electricity, Sir Humphry Davy produced the electric light and the metals of the alkalies; the steamboat, locomotive and telegraph came into existence, and for a time it seemed as if man had all he could attend to in developing the new discoveries. Faraday's investigations led to the invention of the magnet to generator; slowly the idea of a self-exciting dynamo was developed, and slowly enough the world awoke to the idea that the old prophecy of Goethe, that electricity only applied to the smaller business of life, might be falsified. Then, just as the use of currents of electricity of engineering dimensions was being developed, the almost imperceptible but delicately governed induced current was made to produce the transmission of speech; so that now, in our utilization of the thousand horse power units of electricity for engineering work, and of the minute, almost absolute units for telephonic work, we seem equally to avail ourselves of the colossal and of the microscopic powers, of electricity.

The assertion of the progress in science of this century is not needed, and a year ago it would have seemed trite enough to have exalted its achievements. But now, within a few years of the new century, and all within the space of a few months, developments and discoveries, few in number, but of importance enough and wonderful enough to fairly overthrow all our ideas of the limitations of man's power, have been thrust upon us.

The subject of the liquefaction of gases has long been a fascinating one for the physicist and experimenter. Chlorine and carbon dioxide were among the first, a number of years ago, to succumb to pressure, and after awhile scientists established two classes of gases, the fixed and the liquefiable gases. This division no longer exists. All the elemental gases have been liquefied, and the apparatus has been so perfected that with comparatively simple appliances, and in a space of ten minutes, liquid air can be collected like water in an open vessel, and the assertion has been made within a few months, by one of the best qualified investigators of the world, that in the near future liquid air will probably be the great source of artificial cold. Even more wonderful is the liquefaction of air produced by the cold due to its own expansion, which has been accomplished recently on what may be termed the commercial scale. We may within a few years see liquid air supplied and used by the liter like any common chemical.

The old time gas engineer produced hydrocarbon gases from hydrocarbons prepared in preceding geological ages by the mighty forces of nature working through the quiet agency of the profuse plant life of the carboniferous and other eras. The dreams of the advanced technologist, who recognized the crudeness of the coal gas and water gas processes, the latter seeming but slightly an advance over its predecessor, would sometimes take the shape of the future synthesis or direct combination of carbon and hydrogen. If this could be done on the large scale, gas making would stand upon a new and scientific footing. The later triumphs of chemistry are largely in this field of synthesis, and now, in the direct production on the large scale of a hydrocarbon, chemistry has distanced its greatest achievements of the past as far as the technical field is concerned. Acetylene will always remain one of the milestones of the world's progress. Its production is due to the development of the dynamo—it is a gift made by physics to its sister science, chemistry.

The analysis of air was early attempted, and has been made so often that it seemed as if its composition was settled forever. It was always treated as of fixed composition, no variation being found in it wherever collected, unless artificially contaminated. But within a few months the world of science was startled to hear that an element hitherto undiscovered was a constituent of air, and that its composition had never been correctly determined; the new analysis showed the existence in air of the strange neutral

element, argon. Argon and acetylene represent triumphs of the opposite branches of chemistry—of analysis and of synthesis respectively.

And now the world is electrified over a new discovery exemplified by the reproduction of an image of an object through opaque screens by hitherto unknown rays—we allude to Roentgen's discovery of X ray photography. Science had accepted the undulatory theory of light; it had, by referring light phenomena to wave motion of the luminiferous ether, accounted for all the actions of light, a mathematical explanation of refraction and reflection had been reached, and the undulatory theory of light seemed to include actinism or photography. Since the beginning of the present year the epoch making work of Roentgen has been published, and it presents no greater degree of achievement than it does of mystification as it affects the theory of light.

No age has ever witnessed such a succession of triumphs of science in so short a time. The effect of the cumulated wonders is to prepare us for any revelation of science—to almost dangerously increase our powers of belief. They make it harder than ever to discern and fix the true limits of natural science. To the working scientist, the discoveries are an inspiration, for they show him that the extreme elevation of universal knowledge has not yet been reached; he still has heights of discovery to climb, of altitude unimagined seriously by the world of but a decade ago. The synthesis of carbon and hydrogen, the liquefaction of air and hydrogen, the discovery of argon, and the discovery of X ray photography, will add new luster to the names connected with the work. Rayleigh, Ramsay, Dewar, and Roentgen among the pure scientists, and Wilson and Linde among the technologists, will have their fame increased by the renown which their achievements will impart to the expiring nineteenth century.

THE PUBLIC ART LEAGUE OF THE UNITED STATES.

We are in receipt of a copy of the constitution of this league, which has been formed "to promote the passage of a law, or laws, by Congress, requiring that before purchase or adoption by the government of any work of art (sculpture, painting, architecture, landscape design, coin, seal, medal, note, stamp, or bond), the design or model for the same shall be submitted to a commission of experts for an expression of opinion as to its artistic merit; and that the approval of such committee shall be a prerequisite to its adoption."

Richard Watson Gilder, editor of the Century Magazine, New York, is the president, and the list of officers and directors contains some of the most famous names in letters and art in America. We notice among others those of Augustus St. Gaudens, W. M. Chase, Joseph Jefferson, D. H. Burnham, Mrs. M. S. Van Rensselaer, and Charles Dudley Warner.

The object of this league is a distinctly patriotic one, and it should commend itself to all those who have the artistic reputation of their country at heart. The public buildings which are erected by the government of a country, the statues which grace its parks, the parks themselves, the various works of art that fill its museums, and the very designs which are impressed upon all government seals and official documents, are taken by the world at large as representing the best artistic possibilities of the nation.

As a matter of fact, however, it cannot be said that in every case our public works, of the kind enumerated above, do justly express the artistic sense of the American people. Although we have many monuments of art of which any nation might be proud, it is undeniable that others are in existence, and some of them in "high places," which would never have been erected if their design had been first submitted to such a board of experts as the Public Art League is seeking to have established.

According to Article IV of the constitution, persons may become members of the league by authorizing the secretary to sign their names to the constitution. Names should be sent to Mr. Glenn Brown, acting secretary, National Union Building, Washington, D. C.

The Use of Horseflesh in Paris.

The statistical bulletin of the French Ministry of Agriculture, dealing with the consumption of horseflesh in Paris last year, gives the number of horses killed for consumption as food at 23,186, this being exclusive of 43 mules and 383 donkeys. The total weight of meat sold was 5,130 tons, and this was sold at 186 shops or stalls, which are not allowed to sell any other kind of meat. The maximum price ranged from 18 cents a pound for the fillet to 4 cents a pound for the necks and lower ribs. The report adds that not more than a third of the meat is sold at the stalls, the remainder going to make sausages.

The total salmon pack of the Pacific coast during last year, for the full spring and fall seasons, was 2,084,877 cases. Of this amount 627,000 cases were packed on the Columbia River. 637,000 cases in Alaska, and 512,877 cases in British Columbia.

Wells' Algol Variable.

We have received the following report from Prof. William H. Pickering of the astronomical observatory of Harvard College. The report reads as follows:

A minimum of the Algol star, B. D. + 17° 4367, occurred as predicted on the afternoon of January 5, 1896. Through the courtesy of Professor Young, observations were obtained at Princeton by Professor Taylor Reed, with the 23 inch equatorial. It was also observed by Mr. W. M. Reed at Andover. Preparations had been made at this observatory to obtain a series of photographic images of it automatically, each having an exposure of 5 minutes, to observe it photo-metrically with the 15 inch equatorial, and also visually with the 12 and 6 inch equatorials. Unfortunately, owing to clouds, few observations were obtained, but these serve to show that the star was faint and diminishing in brightness as expected. Similar preparations were made for the next minimum, January 10, but again clouds prevented observation.

The observations so far obtained show that its time of minimum, uncorrected for the velocity of light, can be closely represented by the formula $J. D. 2412002.500 + 48064 E$. For nearly two hours before and after the minimum it is fainter than the twelfth magnitude. It is impossible, at present, to say how much fainter it becomes or whether it disappears entirely. It increases at first very rapidly and then more slowly, attaining its full brightness, magnitude 9.5, about five hours after the minimum. One hundred and thirty photographs indicate that, during the four days between the successive minima, it does not vary more than a few hundredths of a magnitude. The variation may be explained by assuming that the star revolves around a comparatively dark body and is totally eclipsed by it for two or three hours, the light at minimum, if any, being entirely that of the dark body. The conditions resemble those of U Cephei, which appears to be totally eclipsed by a relatively dark body two and a half magnitudes fainter than itself, but having a diameter at least one-half greater. The variation in light of B. D. + 17° 4367 is more rapid than that of any other star hitherto discovered, and as its range is greater than that of any known star of the Algol type, its form of light curve can be determined with corresponding accuracy. U Cephei is second in both these respects.

THE NEW STAR IN CENTAURUS.

The Nova follows the nebula N. G. C. 5253, and is north of it. The nebula is assumed to be C. D. M. —31° 10336, magn. 9.5, with which it was originally identified. As seen with a low power the nebula cannot be readily distinguished from a star. Its magnitude on the Cordoba scale by comparison with adjacent stars was estimated by Mr. Wendell as 9.7, and it could hardly have been overlooked in preparing the Cordoba Durchmusterung, in which many adjacent fainter stars are given. The new star could not have been observed at Cordoba unless we assume, first, that it was bright at that time, although invariably too faint to be photographed on fifty nights distributed over six years; and secondly, that the nebula was overlooked at Cordoba while observing fainter objects in the same region. Even if we make these assumptions, the new star still falls in the same class as T Coronae, which was observed in the northern Durchmusterung several years preceding its appearance as a new star.

The positions of the Nova derived from these plates differ from each other by only 0s. '1 in right ascension and 1" in declination. The mean position for 1875 is R. A. = 13h. 32m. 51s. '8, Dec. = —31° 59' 58". It will be noticed that according to these measures, the Nova follows N. G. C. 5253 by 1s. '7, and is 24" north.

Danger in Mineral Wool.

Another report of the Boston Manufacturers' Mutual Insurance Company calls attention, incidentally, to the danger attending the careless use of mineral wool in certain cases. Every one knows that this substance is made by blowing steam or air through melted iron slag. The slag is a sort of impure glass, and the "wool" is, therefore, a mass of fine threads of glass, interspersed, usually, with globules. The threads, though very slender, being finer than cotton fibers, are of glass, and, as the report points out, pieces of them may, unless the material is carefully handled, get under the nails, or into the skin, causing painful irritation; and when the dust from it is incautiously breathed, it has been known to produce hemorrhage. A similar material is "rock wool," which is said to be made of melted glass, and the fibers of which are even sharper and harder, and, therefore, more capable of inflicting injury than those of the slag wool. It may be noticed that the men who apply the mineral wool, which, it is needless to say, is very extensively used in building, for packing pipes, filling in partitions and floors, and so on, do not handle it much, using sticks to compact it in place, and the American Architect suggests that those who have occasion to use it as amateurs will do well to imitate this precaution.

French Honors for Scientists, Artists, and Men of Letters.

On the occasion of the centenary of the French Institute, Prof. Max Müller, who is an Associate of the Academy of Letters, was appointed commander of the Legion of Honor. Prof. Ramsay and Lord Rayleigh, as well as Messrs. Simon Newcombe, Alexander Agassiz, and Rowland, of the United States, who are all corresponding members of the Academy of Science, were made officers of the Legion of Honor; while Mr. Adolphus Hall, of America, a corresponding member of the Academy of Science, was appointed chevalier of the Legion of Honor. In the new year's batch of promotions in the Legion of Honor three American painters, MacEwen, MacMonnies, and Melchers, are made chevaliers; MM. De Morgan, the director-general of antiquities in Egypt, Dieulafoy, the explorer of Babylon, and Leroy Beaulieu, the political economist, are made officers; Francis Chalmes, the essayist, Jules Claretie, director of the Comedie Francaise, Lavis, the historian, Maspero, the Egyptologist, Victor Massenet, Gaston Paris, the romance philologist, and Sully-Prudhomme, the poet, are made commanders; and MM. Joseph Bertrand, the mathematician, Gaston Boissier and Ernest Legouvé, of the Academie Francaise, Leopold Delisle, librarian of the National Library, and Garnier, architect of the Grand Opera, are appointed grand officers.

Household Inventions.*

One phase of household economics which should be made more prominent is that of household inventions. Comparing housework with other industries, it is obviously belated in respect to using mechanical devices and labor-saving appliances; for while farming has been transformed by science and invention, and the life of the agriculturist changed from one of plodding drudgery to one of progressive enterprise, the main processes of housework are done to-day just as they have been for many years. Much hard work has been eliminated, it is true, by mechanical arrangements in the building of our houses; by means of waterworks and heating apparatus the heaviest part of the work, the lifting of wood and water, is dispensed with; and much heavy work has gone out of the house to be done by machine operatives in factories; but, confining our attention to the appliances to be daily handled in the inevitable rotary processes of house cleaning, food preparing, etc., we find these generally done in the old ways practiced by our foremothers, and the mechanical devices employed to be few and simple.

The scrub board, the dishpan, the kneading board and rolling pin, the chopping tray and knife, the broom, the mop, the cook stove, the coal scuttle or wood box, still linger. The potatoes are peeled, the peas shelled, the berries hulled, and the fruit seeded by hand in most households, yet invention waits at our doors. There are endless devices for saving steps, for avoiding dust, for transporting things up and down, which might be studied out in the building of our homes and go in with the laths and plaster. The housewife must have her eyes open to this and "boss the job," since the architect views the home chiefly as the social rather than an industrial center, and the carpenter is guided by other considerations than planning to save woman's time. The perfection of a home plant for housework will only be known when the housewife has a head, if not a hand, in the building.

There are many small, inexpensive appliances to be had—carpet sweepers, meat mincers, salad washers, peeling machines, fruit seeders of different sorts. One who has them all will be in danger of being "cumbered with conveniences," but they give better results with less toil than the old ways and should be always at hand. There are also machines for washing things in the aggregate instead of piece by piece; these save much time, wear, and breakage, and are generally successful in the hands of intelligent operatives. Clothes washers and dish washers are favorites with the housewife who does her own work, and will be placed in the hands of household laborers when we learn to estimate intelligence and time value in the kitchen. Speaking from experience, we believe the dish washer saves more time in the average household than the sewing machine and does better work than the average servant.

Besides these, it is our privilege to bring into use a new order of inventions which mean more to the housewife than all that have preceded. These inventions tend to reduce the processes of housework to scientific accuracy and to eliminate the uncertain factors in the kitchen. Now it is quite possible to bring to lawful terms the cook stove and the bread, if not the baby. The use of liquid fuel in the form of coal oil, gasoline, gas, or electricity is now practicable everywhere for cooking and water heating. The construction of heat savers, or non-conducting cases to surround the heating apparatus, and prevent loss of heat by radiation, gives us the reins by which we may hold out heat supply and control it at will. The Aladdin oven and similar inventions which may be constructed for using lamp power and conserving heat by incasing the heating

*Hanna Otis Brun, in the American Kitchen Magazine, Boston, January. Condensed for Public Opinion.

chest in some non-conducting medium, as asbestos paper, are available for all; they may be adapted to cooking on a large or small scale. A cooking thermometer is one of the indispensables of the scientific kitchen. The process of bread making is reduced to an exact science, since by means of the bread raiser and the new ovens, the temperature at which the dough should be kept during the rising and the baking may be perfectly regulated. Material being reliable, the bread maker can depend upon her calculations for uniform success without the eternal vigilance of the old method. The canning of fruit may be made a delightful pastime by using the steam cooker or Aladdin oven with a lamp.

Launching of the Helena.

The new United States gunboat Helena and the Plant Company's new merchant ship La Grand Duchesse were launched simultaneously at the yards of the Newport News Shipbuilding Company, Newport, News, Va., on January 30, 1896. The Helena is a flush deck fore and aft schooner-rigged steel gunboat, not sheathed, with a double bottom and closed watertight subdivision at the water line. The dimensions are as follows: Length on load water line (normal displacement), 200 feet; maximum breadth, 36 feet; mean draught (at normal displacement), 11 feet; normal displacement, 1,261 tons; full coal capacity, 380 tons; coal carried at normal displacement, 150 tons. The boat is intended to be manned by 150 officers and men. Propulsion will be by twin screws, actuated by two sets of vertical inverted quadruple expansion engines. An average speed of 14 knots an hour must be maintained for four consecutive hours on the trial trip. The battery consists of four 4 inch guns mounted in the open on the upper deck, two being placed forward and two aft in pairs on opposite sides of the ship; four 4 inch guns in armored sponsons on the gun deck, two on each broadside amidship; four 6 pounder Hotchkiss guns, two forward and two aft in 1 inch armored sponsons. In addition to these, the boat will carry one pounder Hotchkiss and Gatling guns on the main deck and it is provided with a bow torpedo tube.

Incrustation in Gas Engine Jackets.

It is not often that trouble is experienced in gas engines owing to incrustation by lime deposited from the jacket-cooling water, but a case is reported where, in two engines, one of 25 and one of 50 horse power, after having been in operation for about a year, different parts, notably the exhaust valves, were frequently found to be very much overheated, the circulation of the cooling water through the cylinder jackets was impeded, and there were often premature explosions of the gas and air charges in the cylinders. On taking the engines apart, it was found that portions of the water pipes leading to and from the jackets, and even the interior of the jackets themselves, were almost completely choked up with a scaly deposit formed by the precipitation by heat of salts dissolved in the water, the action being in all respects similar to that going on in a feedwater heater. Since, however, as shown by thermometric measurements, the cooling water, in flowing through the jackets while the engines were working, never reached the temperature at which lime salts are known to separate from the water which holds them in solution, it became evident that the precipitation must have occurred during the periods just after the engines stopped working.—Water and Gas Review.

Firing the Indiana's Big Guns.

On a recent run of the battleship Indiana from Newport to Hampton Roads, all the guns of her battery, including the 13 inch rifles, were fired. It was the first time they were fired on board ship, and the test showed that the gun mounts and their installation were entirely successful. Such a result was to be expected; so the test was not so important in this respect as it was in another, namely, the effect of the blast of the heavy guns.

The recent test showed no damage to woodwork or glass, nor any serious injury to the officers and men engaged in the firing, but it was conclusively demonstrated that in certain positions of the turret the man in the sighting hood would be exposed to serious discomfort and sometimes actual injury when the 13 inch gun was fired.

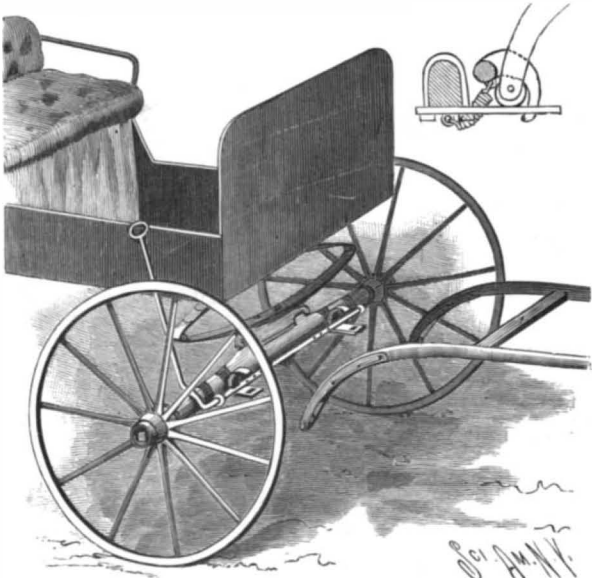
The heavy guns of the monitor Amphitrite were fired in the same manner, to ascertain the effect on her structure and on living animals placed under the decks over which the guns were fired. It was found in her case that no injury resulted to the ship with 12 inch guns, nor to the animals, so far as observed.

Keeping Store Windows Free from Frost.

In large stores a great deal of trouble is sometimes caused by frost forming on the plate glass windows. In Chicago the electric fan has been put into service to avoid this condensation of moisture. The fans are kept going continuously and the current of air seems to carry off the moisture before it can condense and freeze on the glass. It is a new version of the old ventilation cure for the same trouble.

A HORSE DETACHING DEVICE.

To conveniently free a runaway horse from a vehicle, the attachment shown in the accompanying illustration has been invented and patented by Joseph Friedlander, of No. 219 West Commerce Street, San Antonio, Texas, the device being serviceable also for guiding the vehicle after the horse has been freed from it. In bearings secured by clips to the front axle is journaled a shaft from which a handle bar extends up to within convenient reach of the driver, and on the shaft are hooks, each adapted to enter a slot or opening in a forwardly extending keeper plate clipped to the bottom portion of the axle. The hooks may be formed integral with the shaft, or they may have on their heel portions screw shanks

**FRIEDLANDER'S HORSE DETACHING DEVICE.**

adapted to engage threaded apertures in the shaft, thus facilitating the adaptation of the device to vehicles having thills at different distances apart. The thill irons preferably have at their lower ends rollers, as shown in the small figure, and when the handle bar has been moved backward to lift the hooks the thill irons are placed on the keeper plates, a spring connecting the hook shaft with the axle then returning the hooks to the plates immediately upon the release of the handle bar. The slots in the plates may, if desired, have rubber cushions to assist in holding the hooks in engagement with the plates and to prevent rattling. In case of a runaway horse or team, the moving rearward of the handle bar, as shown in the illustration, releases the thills from the vehicle, the driver then keeping hold of the hand bar to guide the vehicle until it comes to rest. This inventor has also applied for a patent on a vehicle brake especially designed for use in connection with the horse detacher.

WALMSLEY'S IMPROVED COMPOUND BLOWPIPE.

This blowpipe is so constructed as to make it specially adapted for plumbers, dentists, and jewelers, giving an exceedingly fine and non-oxidizing flame, making it unequalled for lead burning, using illuminating gas and a flux of soldering salts. It has been patented by Mr. T. B. Walmsley, of No. 905 East 149th Street, New York. It is made in two forms, on a stand, as shown, and without the swivels, so

**WALMSLEY'S IMPROVED COMPOUND BLOWPIPE.**

that it can be used by hand, as in lead burning. The process of lead burning is a new one, and is given in conjunction with the oxyhydrogen process at the New York Trade School, by Mr. Walmsley, as instructor at that admirable institute.

It is well adapted for the use of dentists and jewelers, as the flame is very fine and cannot be blown out—a fault common with other compound blowpipes. It also has several blowpipes of different sizes, which can be put in position at once to suit the work engaged on.

It will be seen that no regulating cock is used on the blast, the difference in size of the blowpipes enabling the workman to get the desired flame by regulating the supply of gas. It may be well to mention that natural or gasoline gas can be burned as well as illuminating gas.

By using a blowpipe in connection with illuminating gas and a flux of Yager's salts a first rate job of lead burning can be done, such as the lengthening of traps and bends and lining of tanks or sinks, where the seams can be burned flat. It will be found easier to the amateur to practice this form of burning than by the oxyhydrogen process, and all the lead burning needed in practical plumbing can be done by this process.

Sheet Lead, Butt Seam.—Fit the edges close and clean, $\frac{1}{4}$ inch wide, with shave hook. Apply the flux with small pencil brush and regulate the flame to suit the thickness of lead to be burned—3 and 4 pound sheet lead, the flame should be very fine, not thicker than $\frac{1}{8}$ inch; 5 and 6 pound lead, $\frac{1}{2}$ inch flame is suitable. If the mouth is used for the blast, blow easily until the lead begins to fuse, then give a circular motion to the flame, and fusion will be complete. The blowpipe should be kept 2 inches from the lead to get the proper heat from the flame.

In using a foot bellows, more care will have to be taken to prevent burning a hole in the lead. The flame must be used more quickly than when the air blast is supplied by the mouth.

Sheet Lead, Lap Seam.—In preparing this seam care must be taken to shave both upper and underneath side of lap, also surface of bottom, allowing the cleaned surface of bottom to project $\frac{1}{4}$ inch. Cut a strip of lead $\frac{1}{4}$ inch wide and use when burning this seam, holding the strip across the seam, melting $\frac{1}{4}$ inch at each movement and in advance of the preceding drop.

Lead Pipe Burning, such as Lengthening of Traps and Bends.—Cut both ends so as to fit close, and with a fine rasp bevel the inside of one end its own thickness and repeat the same on the outside of the other piece; this will give a perfectly smooth interior of the pipe. Shave $\frac{1}{4}$ inch on each piece, making a $\frac{1}{2}$ inch seam. When possible, it is better to use a wood plug or a piece of iron pipe covered with paper when burning; fuse carefully all round, and if the pipe is to be exposed, it can be loaded by using a strip of lead, as in the lap seam, and finished off with a fine file and sandpaper, entirely concealing the point of juncture.

Burning Lead and Brass.—Carefully tin the brass and wipe off clean all surplus solder and slip the brass coupling or ferule $\frac{1}{2}$ inch inside the pipe. Begin by fusing the lead and brass, using freely of flux and letting the greater heat dwell on the brass. A strip of lead can be used to finish this joint when needed. In all cases when burning, keep the blowpipe 2 inches or $2\frac{1}{2}$ inches from the seam, and fusing will the more readily take place. A very little practice is needed to burn a good seam.

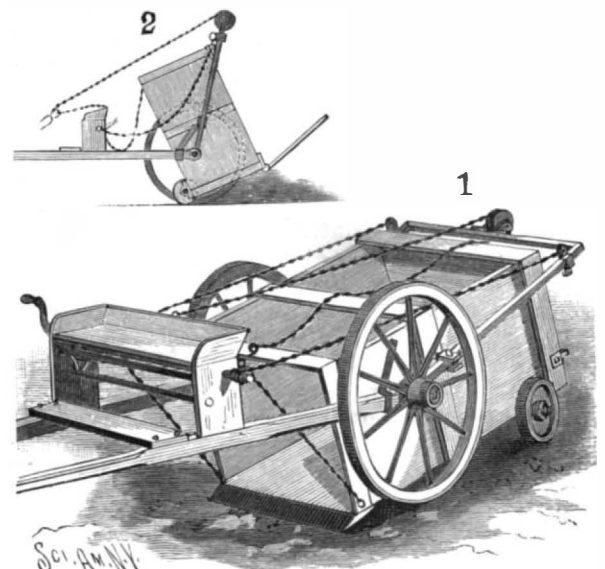
Employer's Liability.

The Supreme Court of Minnesota held, in the recent case of Carlson vs. Northwestern Telephone Exchange Company, that the decisive tests as to whether, in any given case, an employe is to be regarded as a vice-principal or a fellow servant is not his title or his rank, but the nature of the service which he performs; that if he is authorized to perform duties which are the absolute duties of the master, he is to the extent of a discharge of those duties a vice-principal, and that whenever the nature and magnitude of the master's work, whether it be that of construction or otherwise, are such that it is necessary that orders be given regulating the conduct of his employes and directing them where to work, it is not only right but the absolute duty of the master to give such orders, and in obeying such orders the employes have a right to assume that the master, in giving the orders, has exercised due care for their safety. In the case before the court it appeared that the defendant in excavating a ditch placed the work and the men employed thereon, of whom the plaintiff was one, in charge of a foreman, who had general oversight of the work. The men were subject to his orders; he had authority to employ and discharge them and direct them what to do and where to work, and was the supreme authority there present. The foreman negligently ordered the plaintiff from the place where he had been working into the ditch at a point where he had not previously worked, which was a place of unusual danger by reason of a crack in the earth on the side of the ditch and defects in the curbing, which danger and defects were not obvious or known to the plaintiff, who obeyed the order and was injured by the caving in of the ditch. The court held that in giving the order the foreman was a vice-principal and the defendant liable for his negligence.—Bradstreet's.

LONDON barometers on January 9, 1896, showed a pressure of 30.934 inches at 9 P. M. Only four times in a hundred and fifty years has a height above 30.9 inches been recorded. On the same day, near Chester, the barometer reached 31.013 inches.

A SNOW AND DIRT REMOVING CART.

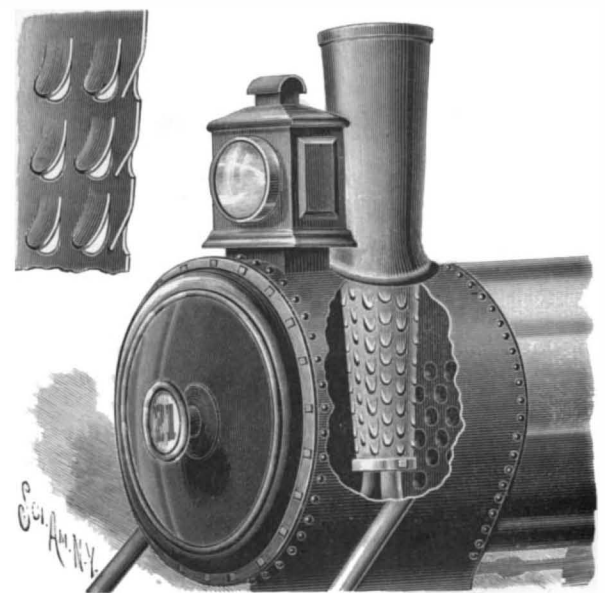
A cart designed to act as a scraper in taking up snow and dirt, as well as afford an efficient vehicle for removing and dumping them, is shown in the accompanying illustration, and has been patented by J. R. Hawkins, of Mountainville, N. Y. The cart is preferably of sheet metal, having a scraper at the front end of its bottom, and is mounted on short axles extended from the ends of a U-shaped frame which has on its side bars adjustable trunnions engaging the sides of the cart body, permitting the latter to swing, the rear ends of the shafts being journaled on the axles, and the shafts supporting a seat for the driver. At the front lower corners of the cart body are eyes engaged by hooks on chains which extend up to the

**HAWKINS' SNOW AND DIRT CART.**

seat, preventing undue dropping of the scraper when the street surface is uneven, and at the rear are small wheels to support the bottom of the cart body at the slight inclination necessary to facilitate the scraping up of dirt or snow from the street surface. To load the scraped up material into the rear part of the cart body, the driver swings the front end of the cart body upward by means of a chain or rope extending rearward from the seat, and passing around a pulley attached to the middle part of the U-shaped frame, the lower run of the chain extending forwardly to a cross bar. On letting go the chain the cart body again swings downward to the position shown in Fig. 1. To dump the contents of the cart, as shown in Fig. 2, chains attached to the rear end of the U-shaped frame are extended to a winding shaft under the seat, and the turning of a crank shaft elevates the rear end of the frame, its movement being checked by stops adjustably held on the shafts. After the frame has been swung up, the winding shaft may be locked, and the other chain pulled upon by the driver to cause the cart body to swing on its trunnions, insuring the complete dumping of the contents.

A LOCOMOTIVE SPARK ARRESTER.

A device designed to prevent the escape to the smoke stack of sparks and cinders, while permitting the free

**SOLOMON'S SPARK ARRESTER.**

passage of the products of combustion, is shown in the accompanying illustration. It has been patented by Edgar J. Solomon, of Carlinville, Ill. To the exhaust nozzle is fitted the lower end of a conical tube whose upper end fits into the lower end of the smokestack, and in the sides of the tube are U-shaped slits, having tongues of metal, which are pressed inwardly as shown in the small figure. The gaseous portions of the products of combustion pass freely upward to the smokestack, while the solid portions, striking the tongues, are thrown back into the smoke box.

AN INTAKE AND FILTER FOR WATER SYSTEMS.

For conveniently filtering large quantities of water and readily cleansing the filtering bed the arrangement shown in the illustration has been devised by and forms the subject of a patent issued to H. L. Ricks, Eureka, Cal. In an open top casing arranged in the bottom of a stream is a longitudinal division formed by slats resting on cleats, and supporting the filtering material, through which the water passes to a settling basin below. The discharge pipe, connected with a reservoir or pump, and adapted to supply water mains in the usual way, leads from the lower end of the settling basin, where it is provided with a strainer, and in its course through the ground is provided with a check valve, beyond which is a branch pipe leading upward into a tank. The branch pipe has a ball valve where it enters the tank, to prevent any backward flow of water through this pipe, and the tank is sufficiently elevated to afford the necessary pressure for efficiently flushing the filtering bed. Arranged vertically in the tank is a casing in which is a pipe connected with parallel perforated pipes embedded in the filtering material, and through these pipes, when the tank is nearly filled, water will be discharged with sufficient force to wash the impurities from the filtering material. The tank may be filled by the back flow of water through the discharge pipe, such flow being interrupted and turned into the tank by means of the check valve, or, where the discharge pipe is connected directly with the pump, a tank near the pumping station may be connected with the flushing tank.

Where the discharge pipe is of considerable length, and is higher at certain points, rendering it likely that air will collect in such portions of the pipe, branch vertical pipes are here located, as shown in the small view, there being in each pipe a rubber ball valve designed to exclude the air when back flushing and clear the intake at high places.

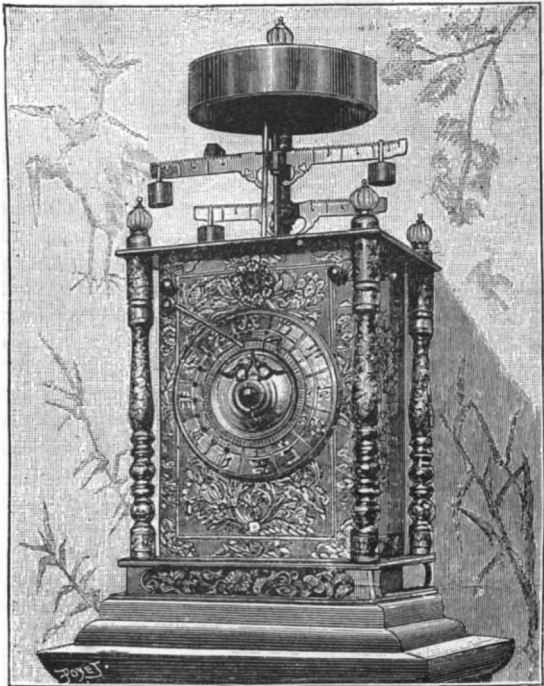


Fig. 1.—JAPANESE CLOCK OF THE EIGHTEENTH CENTURY.

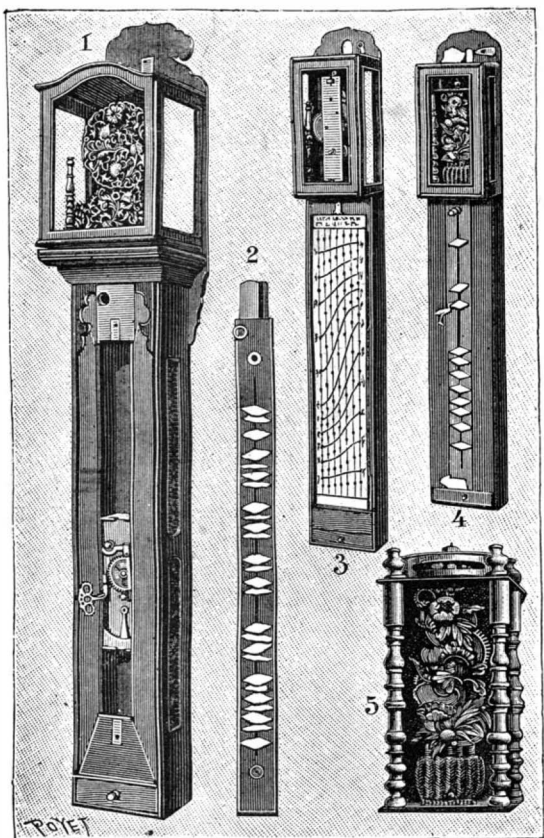
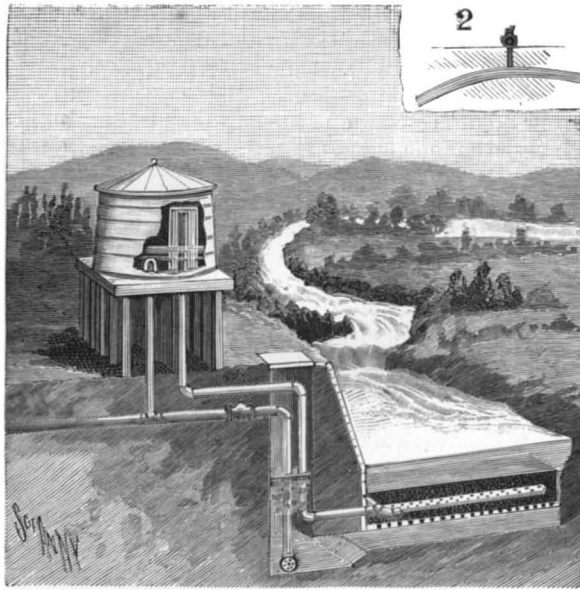


Fig. 4.—JAPANESE CLOCKS OF THE EIGHTEENTH AND NINETEENTH CENTURIES.

JAPANESE CLOCKS AND POCKET SUN DIALS.

The Japanese iron clocks of the seventeenth century were cubical in shape, like the European ones of the sixteenth, and differed therefrom only in the engraving of their surfaces and in the disks of their dials, which were usually of metal lacquered in different colors, with the hours gilded. Later on, this form of



RICKS' INTAKE AND FILTER.

clock, with the case inclosing the movement, was made entirely of copper and of smaller size. Along with those engraved on the solid surface, there were some made in openwork, engraved and of delicate ornamentation.

Columns worked on the lathe, engraved and even enameled, ornamented their angles (Fig. 1). Toward the eighteenth century such clocks were placed in cases of various forms, as was done in Europe. The most beautiful were those mounted upon legs, so as to allow the weights to descend (Fig. 2). These were of porcelain, wood and lacquer work.

The most common form was a sort of truncated pyramid, the four sides of which were solid and of natural or lacquered wood, and upon which the clock was placed. Sometimes the latter was inclosed in a glass case surmounting the pyramid. An aperture at the base of the latter permitted of winding up the weights, which were of copper or lead, and hemispherical, lenticular or cylindrical in shape.



Fig. 2.—CLOCKS MOUNTED UPON LEGS.
No. 1. Porcelain. No. 2. Lacquer work.

In the pieces mounted upon legs, the weights were often concealed in tassels of the same silk as the cord that sustained them.

There were still other kinds of cases in which the clocks were placed, which in form resembled the Dutch clocks of the seventeenth century, and which, like them, were suspended from the wall. They were of wood, and were provided at the sides with pretty little glass doors, and the whole was supported by two brackets (Fig. 3).

In the two kinds of cases that we have just mentioned, apertures were formed at the top, upon three faces, in order that the sound of the bell placed at the upper part of the clock might be distinctly heard. They were lined internally with some sort of fabric to prevent the entrance of dust.

Other forms of clocks, which may be called vertical (Fig. 4, No. 1), were absolutely Japanese in the arrangement of the case and movement. They consisted of a glass case surmounting a very long rectangular body. The material was wood. The movement, placed in the case, was entirely open. The decoration consisted in an engraving or chasing of the front pillar plate and in small columns of metal placed at the angles. Some of these copper pillar plates were beautiful in design, being in lace-like openwork and finely engraved. Others were chased with the greatest care, and certain of them, even, by masters who were not afraid to sign their names. We own one bearing the name of Kouniyouki (Fig. 4, No. 5).

The vertical cases all bore much resemblance to one another. At the base there was a small drawer for the reception of the key. These pieces were suspended from the wall.

The movable cartouches, twelve in number, upon which the hours were engraved, and which constituted the dial, were likewise nearly all of the same form. The dial therefore consisted of these twelve cartouches placed upon the long strip of wood forming the cover of the case that contained the weight, to which latter was fixed a style whose form varied to infinity. This style, mounted upon a rod fixed to the weight, descended in a slot formed near one of the sides of the case, in proportion to the running of the clock work. The twelve metallic cartouches above mentioned were mounted in such a way that they could be regulated by hand conformably to the hour that they were to indicate. The most scientific of the vertical dials were those with lines engraved upon the piece serving as a dial, which, in this case, was of copper.

Upon this plate were engraved twelve vertical lines that corresponded to the twelve fortnights of half a year. Twenty-four curved lines arranged horizontally

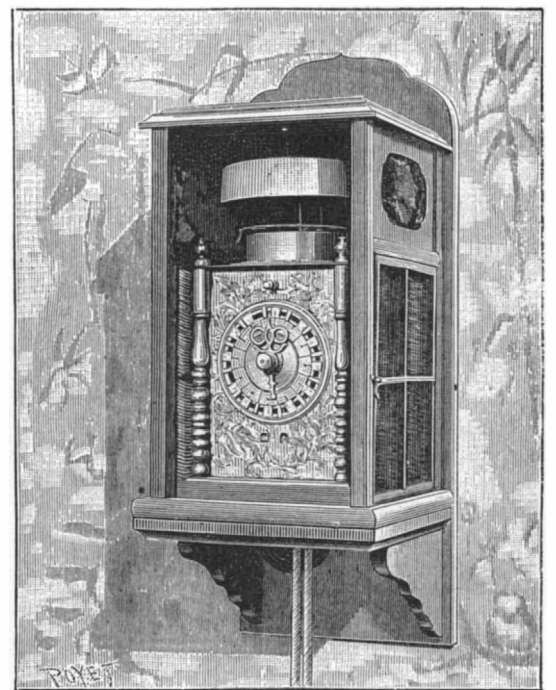


Fig. 3.—JAPANESE WALL CLOCK.

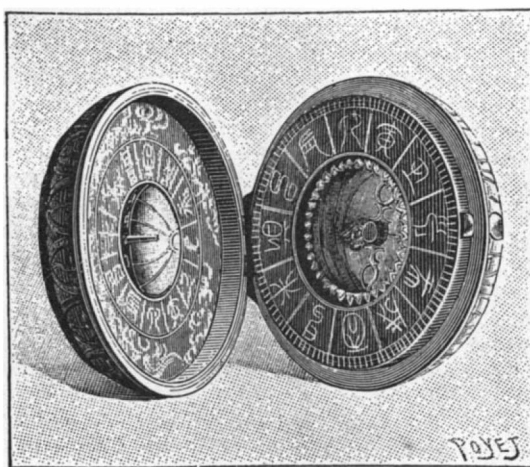


Fig. 5.—JAPANESE POCKET SUN DIAL.

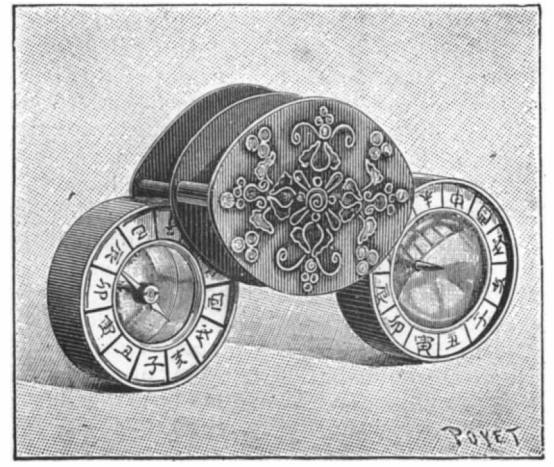


Fig. 6.—JAPANESE POCKET SUN DIAL OF THE EIGHTEENTH CENTURY.

indicated, through their intersection with the vertical ones, the hours and half hours of a day. The horizontal lines had curves that receded from each other progressively in one direction and approached each other in the other, and this permitted of measuring the difference of the days and nights from each other in length. During six months of the year the hour was read in one direction and during the six others in the opposite direction (Fig. 4, No. 3). In this way were obtained the long and the short hours, according to the season.

The intersection of the curves with the perpendiculars marking these different hours was indicated by a light, rectilinear bar placed horizontally upon the engraved plate. This was mounted upon the weight and operated like the index of the vertical dials above mentioned. Japanese clocks struck the hour and the half hour, but there was here a curious peculiarity that we shall describe.

The primitive clocks had the European striking train that struck from one to twelve, with or without the halves. Afterward, the Japanese divided their striking trains so that they corresponded with their hours, that is to say, in counting from 9 to 4 without the halves.

Finally, they made the trains in such a way as to strike the halves, as follows: The half hour was sounded alternately by one stroke or two strokes. For example, in order to indicate half past nine, the train struck one; for half past eight, it struck two; and for half past seven it struck one again, and then two for the following half. This system had one advantage that explains itself. The hours in Japan correspond to two of ours, since only twelve a day are reckoned, instead of twenty-four. The periods of the hours are sufficiently distant from sunrise to sunset to prevent the single stroke or the two strokes of a half hour from being confounded. They serve, on the contrary, to render precise the half of the hour to which it corresponds.

In certain clocks of vertical form the Japanese have conceived the ingenious idea of using a striking train actuated by a spring as a motor for the movement. This train includes a pawl which, at every hour and half hour, meets the prolonged rods of the twelve cartouches upon which the hours are engraved and twelve other cartouches that are ornamental, and are interposed between the preceding and indicate the halves. The pawl, lifted by these rods, causes the striking train to operate. The weight of the train is wound up every day to the top of the case that incloses it, and here the square of the remontoir of the spring of the train presents itself opposite an aperture in the dial, and the spring is coiled with the same key that serves to wind up the cord of the clockwork movement (Fig. 4, Nos. 1 and 2).

We shall explain, according to Kaempfer, how the time of night was announced to the public in Japan.

In certain cities the watchmen did this by striking two wooden cylinders against each other. In others, different instruments were used. Thus, the first hour after sunset was made known by beating a drum; the second, by beating a gum-gum—an instrument in the form of a large flat basin, which, upon being struck, made a loud and piercing noise; and the third, or midnight, by ringing a bell, or rather by striking it with a stick of wood. Then they began over again for the following hours. The sounder, or awakener, whose duty it was to measure the time, was the lowest of the public officers.

The bell that sounded the hours of the day was often that of a temple. It was the rising and setting of the sun especially that was announced with the most care.

Along with mechanical clocks, the Japanese used portable sun dials, some of which had the form of a watchcase (Fig. 5). To the center of one of the halves of the case was fixed a small gnomon, the shadow of which reached the plane surface of the periphery, which latter, according to the Japanese system, was divided into twelve hours. The other half of the case carried in its concavity a magnetized needle, which oscillated freely in the horizontal plane. Beneath this needle there were four characters, which were 90 degrees distant from each other and designated the four cardinal points. The circular plane surface of this half of the case was divided into twelve parts, corresponding to those of the opposite side and marked with the same numbers, but in inverse order. In order to make use of the sun dial, it sufficed to orient it by means of the magnetized needle, and the direction of the shadow of the little style would then permit of estimating the timemore or less approximately. Other sun dials consisted of two hollow disks, one of them containing the compass and the other the style. These two parts folded one over the other and entered a case to which they were jointed (Fig. 6). This arrangement is essentially Japanese. The other form has often been made for Japan in Holland.

The Japanese have as a proverb: "The style and the disk, despite their great utility, are not as valuable as an inch of shadow."

The sun dials of which we have spoken, as well as

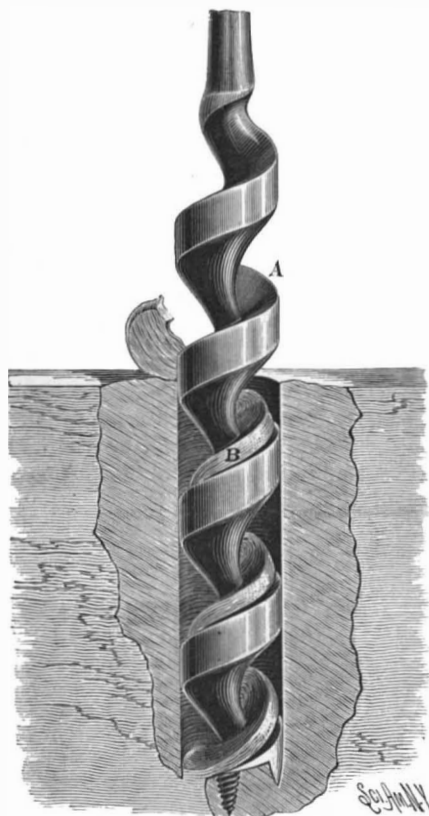
the clocks that we have described, are manufactured by clockmakers, who are called in Japanese *tokei*, while their shops are styled *to-kei-yo*.—La Nature.

AN IMPROVED BIT.

We illustrate the Ford patent bit, a tool which has been subjected to thorough testing upon different kinds of wood and which has a distinguishing peculiarity over other bits, which lies in the twist.

Its shape is determined by and defined as that of a single concave twist. This gives it a single cutting edge and a single projecting lip. The thread of the screw point is a continuation of the twist of the upper part, so that one merges into the other. The concave shape of the upper surface of the twist has the effect of drawing the borings toward the center or axis of the bit, thus preventing friction of borings against the sides of the hole, and thereby also preventing choking. For this bit, the necessity of constantly withdrawing for removing the chips does not exist. The cut shows the self-cleaning action of the tool, and also presents its general shape. The drawing was made from an actual boring with the bit, the hole being made one-half in each of two separate pieces of wood, which were then separated to give the model for the artist and to show its action.

The bits were tried in different kinds of wood vertical to the grain, diagonal thereto, and in other ways. The straightness of the hole was also remarked, and the absence of any tendency to split the wood was an evidence of the good clearance. The screw point



AN IMPROVED BIT.

held its grip very well, no pressure whatever being required for the feed, even in end grain boring. The action of the edge is a true cutting one, not a scraping one. The Ford Bit Company, of Holyoke, Mass., are the manufacturers.

Improved Calorimeter.

An improved calorimeter, for the application of the method of mixtures in determining specific heats, is described by Mr. F. A. Waterman in the *Philosophical Magazine*. Mr. Hesehus' ingenious suggestion is acted upon, to maintain the calorimeter, after the introduction of the heated body, at a constant temperature by means of cold water, instead of measuring the rise of temperature of the calorimeter. This arrangement gets rid of the radiation error, and eliminates the "water equivalent" of the vessel. By dropping the cold water in, stirring is also made unnecessary. The method has been placed by Mr. Waterman upon a footing of equality at least with other methods, but his success may be partly due to other improvements. The body experimented upon is heated by a coil of wire conveying a current, and surrounded by ice. The initial temperature of the body may thus be regulated by simply maintaining the current of a certain strength and this temperature can be kept constant for five or six hours together to within 0.1° C. The body is then plunged into a silver calorimeter surrounded by the bulb of a delicate air thermometer indicating a difference of temperature of 0.01° C. The cold water is contained in a copper vessel having the shape of an inverted cone surrounded by ice. In this manner the ice cannot melt away and leave a free space round the vessel. The water dropping arrangement and the electric heater are mounted on vertical axes in such a manner that they can be quickly swung into position just above the calorimeter. After the heated solid or liquid has been dropped in, the water dropper is set

to work, at first rapidly, and then slowly, until the body has assumed the original temperature of the calorimeter. For bodies of the same weight and the same initial temperature, the specific heat is then, Nature says, simply measured by the amount of ice cold water necessary to cool them to the temperature of the room.

Acetylene for Steam Engines.

The use of acetylene for the production of power has been suggested several times since it has become a commercial product; but Dr. A. Frank, of Charlottenburg, has stated its advantages and disadvantages for the purpose very explicitly in the *Journal für Gasbeleuchtung*. Calcium carbide capable of yielding 90 per cent of the theoretical amount of acetylene which the pure carbide should give is now obtainable from the works of Bitterfeld; and a very good article is also now made at Neuhausen. Dr. Frank suggests that the carbide furnishes an excellent means of transporting power (derived from water for instance) to a distance from the source. He considers Herr Ihering's proposal to compress acetylene to a liquid at a pressure of 50 atmospheres for transportation a less practicable one than that of conveying the calcium carbide itself. He bases this conclusion on the following figures: 64 parts (by weight) of calcium carbide on addition of water should produce 26 parts of acetylene; or 100 pounds of calcium carbide should yield 40.62 pounds of acetylene=559 cubic feet at atmospheric pressure. The liquefied compressed acetylene weighs 28.15 pounds per cubic foot, or 40.62 pounds occupies 1.443 cubic feet; while the calcium carbide necessary to produce this quantity will have a volume of only 0.722 cubic foot, taking its specific gravity of 2.22. The volume of the calcium carbide is therefore about half that of the acetylene gas it would yield, when the latter is stored as a liquid under a pressure of 50 atmospheres. The space occupied by the walls of the containing vessel is, moreover, unconsidered in this comparison of volume. But the commercial production of acetylene from the carbide only gives 90 per cent of the theoretical yield; and therefore 111 pounds of carbide would be required to produce the 40.62 pounds of acetylene, and a space of 0.800 cubic foot would be occupied by it. The calcium carbide may be run into cubical or other rectangular blocks; and these may be put into light tins for protection from the air and moisture. The liquefied acetylene, on account of the weight and shape of the containing vessel, needs more space than the carbide for its storage.

The liberation of the acetylene from the roughly powdered carbide may be effected with simple apparatus. It may be observed that recent experiments show that the toxic properties of acetylene have been much overrated. Small mammals can remain for half an hour in an atmosphere containing 4 per cent of acetylene without perceptibly suffering inconvenience. Slight leakages from the generating apparatus need not, therefore, be regarded as dangerous to the workmen. If a comparison of the weight and volume of coal, liquefied acetylene, and calcium carbide needed to provide power for a 1000 horse marine engine for 25 days is made, the following results:

1. COAL.—The 600,000 horse power hours will need, at 1.543 pounds per horse power hour, 413 tons of coal, occupying, when well stowed, a space of 14,800 to 15,200 cubic feet.

2. LIQUID ACETYLENE.—According to Ihering and Slaby's figures, 0.4 pound nearly is required per horse power hour with large engines, or 106 tons for 600,000 horse power hours. A specific gravity of 0.451 at 0° C. corresponds to 364 at 35.8° C. (about the temperature of the ship's hold); and therefore 106 tons would require vessels of 9,500 to 10,600 cubic feet capacity, and these to be absolutely safe at a pressure of upward of 50 atmospheres.

3. CALCIUM CARBIDE.—The corresponding amount of 90 per cent carbide would be 295 tons, which, at a specific gravity of 2.22, would occupy a space of 4,625 cubic feet; or, allowing for the tins in which the blocks are stored, about 5,300 cubic feet.

Therefore to supply power for 25 days to a 1,000 horse power engine requires: Good coal, 413 tons, having a volume of 14,800 cubic feet; compressed acetylene, 106 tons, having a volume of 9,890 cubic feet; or calcium carbide, 295 tons, having a volume of 4,770 cubic feet. Moreover, coal needs a boiler which is expensive both in first cost and in maintenance; while liquid acetylene requires large storage vessels, whereas simple apparatus only is needed with the carbide. To one unversed in shipbuilding, it seems that, in the endeavor to find a very concentrated form of fuel to fit war vessels for long journeys, calcium carbide must attract attention. Stationary and locomotive engines on land might also use it, and be independent of foreign petroleum, which has lately also been used for ships' boilers.—*Journal of Gas Lighting*.

WHAT is claimed to be the largest single pane of glass in the country was received at Hartford, Conn., from Belgium recently. It is 12½ feet high, 15½ feet wide, ½ inch thick, and weighs 1,800 pounds.

ROENTGEN OR X RAY PHOTOGRAPHY.

The discovery of X ray photography by Roentgen will serve not only to immortalize the physicist who so fully developed it before giving it to the public, but it will render the year 1896 distinguished as the "Roentgen photography" year, as 1894-95 are distinguished as the "argon and helium" years. It seemed as if the limits of human discovery were being reached, but the wonder of the new photography only emphasizes the possibility of other victories to be won in the world of science. It was by aid of a fluorescent medium that the course of the rays was traced and the proof of their penetration of solid opaque organic screens was reached.

Roentgen's first experiment consisted in placing near a Crookes tube, which was enveloped in black paper or pasteboard, a screen whose surface was charged with a fluorescent substance. On exciting the Crookes tube, the surface of the experimental screen became luminous. A book of a thousand pages was placed between the tube and the screen, but the luminosity persisted. Wood and aluminum were also tried with like result, and it was found that if the hand were interposed the image or shadow of its osseous skeleton was obtained on the fluorescing and luminous surface. To try the effect of the newly discovered rays upon a photographic plate was but natural. It was tried, a photograph through an opaque screen resulted and the discovery was complete. This account disposes of the story of the discovery having been made accidentally.

The experiments, as described by Continental authorities, require a coil giving a spark from 2'4 to 3'2 inches long. Four inches is named as a good distance to intervene between the Crookes tube and the sensitized plate, and ten to twenty minutes are given as the limit of exposure. We publish in the SCIENTIFIC AMERICAN SUPPLEMENT of this week, No. 1050, Roentgen's photograph of the bones of the human hand. An interesting feature in it is the ring on the finger. The metal cuts off the rays far more than do the bones, as the latter cut them off more than the muscular tissue or epidermis does. Hence in graduated intensities we find shown the full outline of the hand in light color inclosing the darker outline of the bones, while the metal ring shows darker than all.

It is with no small gratification that we are able to put before our readers the exact details of the experiment, as carried out by Prof. A. W. Wright, of Yale University. He was among the first of the American experimenters, and his results figure as among the most successful ones yet obtained.

The arrangement of the apparatus is clearly shown in the front page engraving, which was prepared from sketches made by our artist in Prof. Wright's laboratory.

On a clamp support is carried the Crookes tube. Prof. Wright used one of approximately spherical shape of the type originally used by Prof. Crookes to show the dependence upon the negative pole of radiant state phenomena. The tube was experimented with in two positions, the plate or one of the wires being made the cathode, the bulb being always so placed as to keep the cathode uppermost.

The excitation was furnished by an induction coil, the primary of which was excited by a five-cell storage battery and the secondary was taken as giving 200,000 to 300,000 volts potential, corresponding roughly to a spark length or distance between electrodes of two to three inches in air. Wires from the secondary were connected to the terminals of the Crookes tube as shown, the negative wire to the upper electrode.

On the table, a few inches below the tube, the sensitized plate contained in an ordinary plate holder was placed, and on its slide of ebonite were placed the objects to be photographed. They were a purse with coins in it, a box containing aluminum wire weights, a pasteboard pill box in which some balls of different metals were placed embedded in cotton, medals and coins, and a lead pencil. The tube was excited for some minutes, the plate was removed and developed, and the results are shown in a reproduction of the photograph which Prof. Wright furnished us. This photograph is of the highest interest. It shows the objects detailed above. On one side can be seen the dim shadow of a box with the bent wire aluminum weights in it strongly outlined; the pencil shows the lead through the wood; the purse reveals its contents; the box with the little metal balls does the same, while the coins produce at least their contour. All these effects were produced through the ebonite cover of the plate holder. The plate used was a very rapid Cramer dry plate; the image was developed with eikonogen.

The photograph we reproduce possesses historical interest, as being one of the first of the Roentgen photographs produced in the United States.

From Prof. Wright we have received the following latest particulars concerning the details of his experiments:

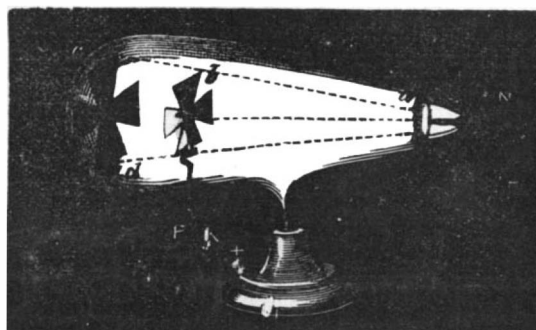
"A curious peculiarity of the plates which have been subject to the cathode rays, as compared with those

which have been acted upon by light, is their great sluggishness in development. The image does not appear at all for a relatively long time, and then comes up very slowly, so that the development must be continued a very long time to bring out all there is in the picture. When this is fully out a remarkably strong and dense negative results, with very strong contrast. Cramer and Seed plates of the highest degree of sensitiveness have been used in the later experiments. The time of exposure may be shortened by placing the objects on sensitive plates nearer the Crookes tube, but the definition in the picture is then not so good. The plates should be opposite the cathode."

At the meeting of the Royal Photographic Society, in London, on January 21, Mr. J. W. Gifford, of Chand, showed a number of Roentgen photographs which he had produced, using five to ten minutes' exposure. He stated that he had obtained somewhat similar results without a Crookes tube, using the sparking electrodes of an induction coil to photograph a hand inclosed in a box with a photographic plate.

It is some eighteen years since Crookes tubes were prominently brought into service. They are simply tubes or vessels of thin glass into whose walls platinum wire electrodes are sealed hermetically and which are then exhausted to a very high degree, to about one millionth of an atmosphere. The tubes are of different shapes, to enable different experiments to be performed with them. We reproduce, from an article on Crookes tubes in our SUPPLEMENT, No. 189, of August 16, 1879, a view of one of the tubes, which is of special interest, as showing the production of a shadow by a cathode discharge. The cross is made of sheet aluminum. The cathode connection is made at N, the anode at P. The walls of the tube become luminous under the effects of the discharge, with a shadow of the cross projected on them.

While the shadow shown is of a certain interest from the point of view of analogy, it must be remembered that the X rays are distinguished by Prof.



CROOKES TUBE, SHOWING SHADOW.

Roentgen as sharply from cathode rays as from ordinary light rays. Light rays can be refracted or bent from their straight course by passage from one medium of transmission into another, they can be reflected from surfaces of substances which they cannot pass through. The cathode rays can be bent to right or left out of their straight course by a magnet; but the X rays act most anomalously. While transmitted with varying facility by different substances, some being opaque to them, others transparent, and while these different substances vary in degree between full opacity and almost full transparency for the rays in question, neither reflection nor refraction of X rays has been absolutely proved to exist. A very small index of refraction has been indicated, not shown, for the rays, and an imperfect demonstration of reflection has been made. In their simplicity and directness of action they even suggest gravitation, except that there is no screen for the universal force.

There is now opened a limitless field for experiments, possibly special plates, prepared with fluorescent or other compounds in the emulsion, may be used, and the extension of the scope will interest the professional world from surgeon and physician to metallurgist and engineer. Every day brings accounts of new experiments, it being proposed even to take a photograph of a man upon a plate large enough to receive the shadow. It is said that a negative plate six feet high is being prepared with that object.

The non-refractability of the rays makes it impossible to produce a reduced image; every object photographed as it is done by radiant energy directly must be done by its shadow, and the shadow must be practically of the same size as the object or a little larger. Again, as no light is used in taking the photograph, there is no way at present of determining the proper exposure, the photometry of Roentgen rays being as yet unaccomplished.

Etymologically there is a chance for a new name—a photograph taken without light being an etymological absurdity.

From the point of view of pure science, it is impossible to predict what the result will be. We have a radiant force or energy which penetrates matter with varying degree of facility, yet which apparently cannot be refracted. We have something which may

greatly modify our views of the action of the luminiferous ether, and which may help us eventually to a tangible theory of the great cosmic mystery—gravitation.

We especially desire to refer our reader to our SUPPLEMENT of the present week for Prof. Roentgen's original memoir on his great discovery, which we did not have space to publish in this issue. There will be found a succinct account of his investigations, set forth in form which should make his work a model for future investigators.

The Housemaid and the Dustpan.

To those who know the true inwardness of things the sight of a housemaid brushing a dusty carpet is suggestive of many evils. The death of Pasteur has reminded the world of what is constantly present in the thoughts of medical men—namely, that while micro-organisms are the great producers of disease, dust is the great carrier of micro-organisms. Now that we know these things, it is distressing to find how little our knowledge is put to practical use, and to see old customs still unchanged, old habits which we know to be destructive carried on, and to find the housemaid on her knees, with her brush and dustpan, stirring up dust to the detriment of everyone, and breathing germ-laden particles to her own destruction. It needs but a small amount of common sense to see that if carpets must continue, a thing greatly to be deprecated, they should be rubbed with a damp cloth rather than brushed, and that if, in deference to prejudice, they must be brushed, this should be done by a covered American sweeper with plenty of damp tea leaves. Of all ways of removing dirt from a carpet the worst is by the use of the ordinary short brush, which involves the housemaid kneeling down in the midst of the dust which she so needlessly creates, and drawing it into her lungs with every breath. For ordinary household use something like linoleum, something which can be washed with a wet cloth every morning, would seem to be the best covering for floors; but if carpets must be, and it is impossible to teach the present generation the evils of seeking present comfort at the expense of future risks, at least let us remember that carpets may be washed even where they lie; that, till the day of washing comes, a closed sweeper is far better than a brush, and that the worst form of brush is one with a short handle.—British Med. Journal.

A New Heavy Liquid.

A new heavy liquid has been discovered. Mr. S. L. Penfield describes its preparation in the December number of the American Journal of Science. Mix equal proportions of the nitrate of silver and thallium, and on heating the mixture it fuses at 75 degrees C., forming a clear mobile liquid of density 4.5, which mixes with water in all proportions. It can, therefore, be used to separate mineral particles of densities below 4.5. When still heavier particles have to be separated, the proportion of thallium may be increased. When the ratio is 3:4 the mixture fuses below 100 degrees C. and has a density of about 4.7. At 2:4 the fusing point becomes 150 degrees C. and the density 4.8; at 1:4 it is about 4.9 and fusion only takes place at 200 degrees. Finally, when pure thallium nitrate is used, the point of fusion is 250 degrees C. and the density closely approaches 5. This high range of densities, together with the fact that the salts do not attack many minerals, make the liquid especially valuable for mineralogical purposes. A convenient separator is described by the same author. It consists of a thimble-shaped cup, into which a wide tube is made to fit. The tube can be closed at the bottom by a hollow plug. This plug being removed, the heavy liquid is poured through the tube into the thimble, and the minerals are thrown in and stirred. The heavy particles sink into the thimble, and may be removed by closing the tube with the plug and withdrawing the thimble. The latter is then replaced, and the operation repeated with dilute liquid. With some practice an elaborate separation by densities is rapidly and easily accomplished.

THE United States Consul-General at Bogota, in a recent report to the state department, expresses the belief that American merchants are not alive to their opportunities in South American markets. For instance, if a merchant of Bogota sends an order to an American manufacturer for goods cut to a certain length and width, the manufacturer writes back that he does not cut goods in those dimensions, and will not fill the order unless the goods can be taken as they are. For this reason the foreign trade in that part of the continent is being largely taken by German and British manufacturers, who are more accommodating in this respect.

Two Sicilian scientists, says Popular Science News, Grassi and Rovelli, have recently discovered that the housefly is the intermediate host of a species of tape worm which does much harm among chickens. The chickens eat flies whose bodies contain the larvæ of the tape worm.

A DIRECT-CONNECTED MOTOR AND LATHE.

The accompanying engraving, which is made from an illustration and description which appeared in the Mining and Scientific Press, of San Francisco, shows a novel application of the electric motor to shop work, in which the customary overhead shafting is completely done away with, and its place is taken by a motor which is built into the headstock of the lathe—in this case a 46 inch Niles Tool Works lathe. Apart from the economy which results from directly applied motive power, the removal of the overhead shafting and belting allows a much freer disposition of the various tools in a shop, for the reason that they do not have to be located with reference to their accessibility to the overhead traveling crane. The motor runs in either direction at nine different speeds, which vary between 57 and 275 revolutions per minute. The speed is controlled by a lever at each end of the apron of the carriage; and it is so conveniently placed to the operator that, without changing his position in front of the tool, he can at will either stop the lathe or change the motion instantly from any speed in one direction to any speed in the opposite direction. The operator has no belt to shift in changing speed, as in the ordinary lathe; and, consequently, in facing off work he can keep the tool at all times cutting up to speed, as it travels toward the center. In chasing threads, he can make a quick return by utilizing the high speed. In order to gain two speeds without shifting a belt, it is usual in turret lathes to provide mechanism for quickly throwing in or out some clutch or gears; but by means of the direct-connected motor the lathe can be instantly run at any one of nine speeds by the operation of the above-mentioned controlling levers.

The motor is built by the Card Electric Motor and Dynamo Company.

A COVERED SPIRAL BICYCLE PATHWAY IN PARIS.

With the enthusiasm and spirit characteristic of his race, the Frenchman has plunged into the sport of bicycling with an interest which almost casts into the shade our own devotion to this form of exercise. The bicycle is found everywhere in Paris, even in great numbers upon the most crowded thoroughfares. The Frenchman generally rides with great skill, and in the wheel he has found a friend particularly adapted to his restless nature. Men and women ride the somewhat willful tandem on the most crowded streets, and often at great speed, but, strange to say, accidents are less frequent than would be imagined. The winter months in Paris are naturally ill adapted to the sport, and the enthusiast is therefore driven under cover. Probably the greatest novelty in the way of a bicycle academy is the spiral path shown in the accompanying illustrations, for which we are indebted to the Genie Civil. This establishment is called the "Palais-Sport." The building was originally used for the military panoramas of the celebrated painters De-
taille and De Neuville, representing the

battles of Champigny and Rezonville. The projectors of the new establishment transformed the lower stories into various waiting, reading and dressing rooms, as well as private rooms where beginners can escape the eye of the curious. The various store rooms and repair rooms for the bicycles are also provided. The spiral pathway extends from the main floor of the academy

rated somewhat elaborately with pastoral scenes, giving the effect of the country. The bicycles are brought to the main floor from the storage room by means of elevators.

Gas Engine Stations for Trunk Line Railways.

Mr. Westinghouse said in a recent speech that the strong argument heretofore used against the adoption of the electric system for main lines has been due to the fact that the investment required to make the change would be heavy, without materially decreasing the consumption of fuel and other costs of operation—an objection which it is believed can be met by the development and use of gas engines of large sizes instead of steam engines for the generation of the electric current. After presenting arguments to show that the gas engine would use but one-eighth the fuel of an ordinary locomotive to produce similar power, Mr. Westinghouse continued: "The Pennsylvania Railroad to-day, it is said,

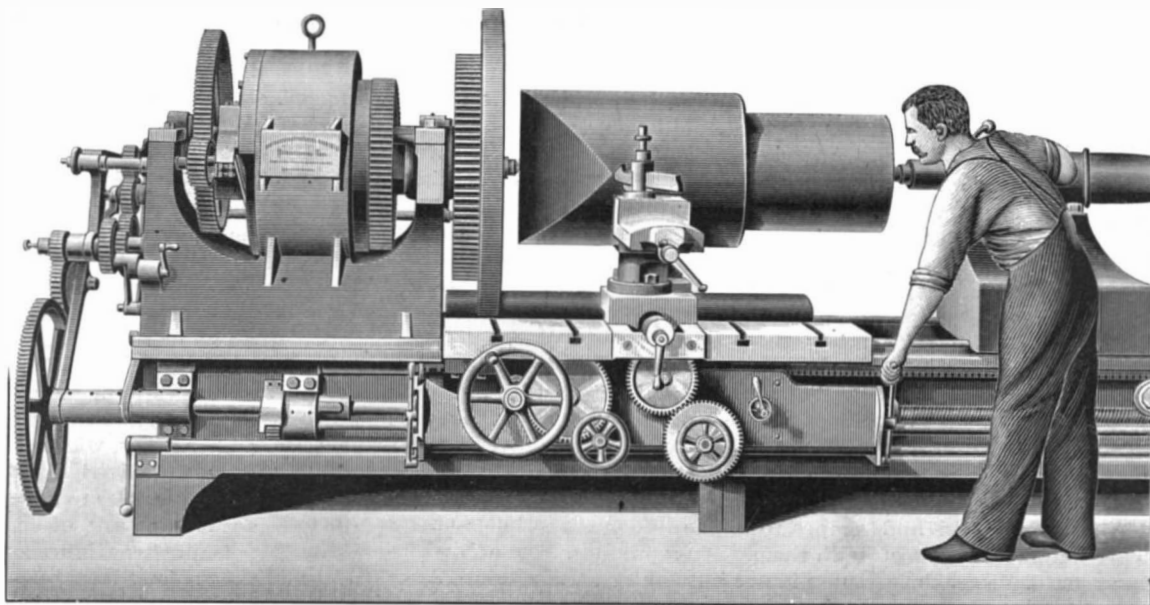
consumes about 5,000,000 tons of coal per annum on its lines east of Pittsburg, taking, approximately, 20 loaded trains each day for its transportation, and consequently the return of 20 empty trains, and requiring for the service of the company alone fully 3,000 cars and a proportionate number of locomotives. If this power were to be generated by gas engines, only about one-eighth, or 600,000 tons of coal per year, would be required, effecting a saving of over 4,000,000 tons of coal, now costing the railway company above \$5,000,000—a saving which would justify a large enough capital expenditure to cover the complete equipment of the railway. To carry out an arrangement of this character, stations having electric generating plants with gas engines and producers could be located at intervals of from ten to twelve miles, so that there would always be two or three stations furnishing current for any particular part of the line."

Aluminum.

M. Henri Moissan has been investigating the contradictory results which experimenters have arrived at with reference to some of the properties of aluminum. M. Moissan ascribes these to the fact that all commercial samples of this metal contain impurities. The effects of nitrogen and carbon he has already dealt with, and having had occasion to analyze samples of aluminum from the works at La Praz (France), Neuhausen (Switzerland), and Pittsburg (United States), he has now discovered a new

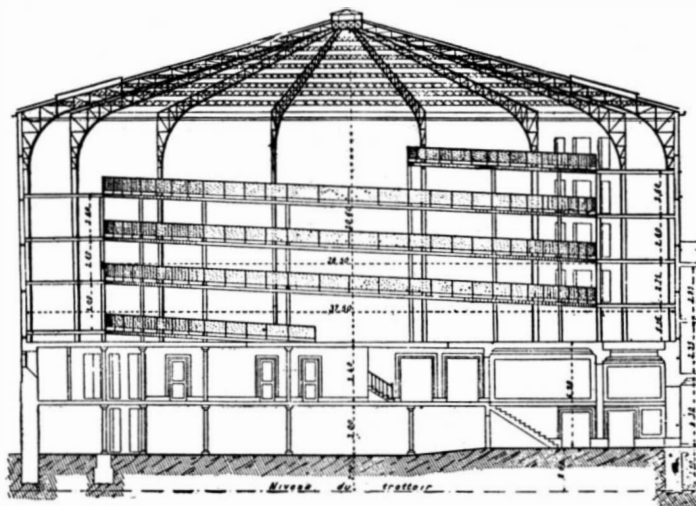
impurity—namely, sodium. This may be present to the extent of from 0.1 to 0.3 per cent, and renders the aluminum liable to be slowly attacked by water. The presence of a small quantity of sodium also completely alters the character of aluminum alloys.

THE Microscope gives this formula for an ink for writing on glass with a pen, as with ordinary ink: Bleached shellac 10 parts, Venice turpentine 5 parts, lamp black 5 parts. Dissolve the shellac with turpentine and stir in lampblack.

**A DIRECT-CONNECTED MOTOR AND LATHE.**

to a point near the roof. The ascent is gradual, being about 25 to the 100, the total height being 36 feet. The pathway is divided into two paths by an inverted V-shaped board screen, the entire length of course, including the ascent and descent, being over a thousand yards.

The path is extended at the top into a spacious platform which enables the rider to make an easy turn before taking a long coast to the main floor below. A high screen protects the wheelman from being precipitated below in case of accident. A spacious room is reserved for spectators. The outer wall of the spiral is deco-

**DETAIL OF CONSTRUCTION OF THE PALAIS-SPORT.****A SPIRAL BICYCLE PATHWAY—PALAIS-SPORT IN PARIS.**

SOME AMERICAN MOTOR CARRIAGES.

This is an age in which it is not safe to deride any forecast in mechanics, so that the prophecy, now often made, that in the near future the clatter of the horse's hoof shall no longer be heard on the fashionable drive-ways, and that the noiseless bicycle and the pneumatic tired wheels of the motor carriage shall reign

trolem carriage, which made the entire journey in 2 days and 53 minutes, or at the rate of 14 9-10 miles an hour. With a laudable attempt to awake widespread interest in the motor vehicle in this country, the Chicago Times-Herald offered prizes last July aggregating \$5,000. We have already published full particulars of this contest, which occurred at an unfortunate time of

persons, weighing 2,750 pounds in running order, but the third seat was removed, so as to give increased space for the batteries, and the wheels, which were formerly provided with steel tires, are now provided with solid rubber tires. A new motor of the Lundell type has been placed in it. We understand that the manufacturer is now engaged in constructing a new



AMES' STEAM CARRIAGE.

supreme, while undoubtedly exaggerated, still holds true to a certain extent.

In the early part of the century there was a period of development of steam carriages, but at that time there were no such favorable conditions for success as those which surround the experimenters of to-day, as the roads were bad and only steam was available as a motive power. But since that time not only has road making been reduced to a science, but the cumbersome motor wagon and engine has given place to the steel framed pneumatic tired vehicle, and various forms of light motors have been devised, actuated by one of the many products of petroleum or by steam, gas or electricity.

In 1894 a great impetus was given to the automobile carriage by a competition organized in Paris by the Petit Journal. The course was from Paris to Rouen, 75 miles, and the prizes amounted to 10,000 francs. Fifteen competitors took part in the race, which occurred

the year as regards the weather, so that the results obtained were not as valuable as they would have been had the race occurred earlier in the season.

It is gratifying to note that there will also be a race in this country in May. The Cosmopolitan Magazine offers \$3,000 in premiums to be awarded to motor carriages presenting the greatest number of points of excellence as exhibited in a trial trip to be made from the New York office of the Cosmopolitan, City Hall Park, on Saturday, May 30 (Decoration Day), 1896, to the Cosmopolitan building at Irvington, and thence back to the starting point.

The award will be made upon the following points, the maximum being 100; speed, 50; simplicity and durability of construction, 25; ease in operating and safety, 15; cost, 10. Entries must be sent to the office of the Cosmopolitan before May 1. The names of the judges will be announced in the March issue of the Cosmopolitan.



MORRIS & SALOM'S CRAWFORD WAGON.

carriage. The vehicle shown in the engraving has four wheels, the front wheels being 3½ ft. and the rear wheels 4 ft. in diameter. In the body are thirty-six storage battery cells, with a capacity of 250 ampere hours. These batteries actuate a three horse power motor and the power is transmitted to the axle by single reduction gears. The carriage has a speed of three to ten miles per hour on good roads, and the storage batteries enable it to travel about seventy miles on a hard level road without recharging. In the Chicago Times-Herald race, the condition of the roads was such that the wheels of the Sturges carriage slipped very badly in the six inches of snow, and nearly double the usual power was exerted, so that the carriage traveled with the speed of only 4¼ miles per hour, the batteries becoming exhausted after a run of thirteen miles. The Sturges machine received an award of \$500 for the showing made in the road race.

Although the Morris & Salom "Electrobat" did



HERTEL'S GASOLINE CARRIAGE.

in July. The best time made was 5 hours 40 minutes. The gasoline motors, as usual, made the best showing in the contest. On June 11, 1895, occurred another race in France, for prizes aggregating 40,000 francs. The course was from Paris to Bordeaux and return, a distance of 727 miles. Sixty-six horseless vehicles competed, and the best time was made by a pe-

We present illustrations of four American built motor carriages, some of which have been very successful. Mr. Harold Sturges, of the Sturges Electric Motorcycle Company, has devoted attention to the electric motor vehicle for some three years, and he had a carriage on exhibition at the World's Fair. The carriage which we illustrate was originally a three seated sulky for six



STURGES' ELECTRIC MOTOR WAGON.

not attempt to run over any great part of the course of the Chicago Times-Herald race on last Thanksgiving Day, it was still awarded the great gold medal by the judges for pre-eminence, because of the following points of merit. The award of the judges states that the medal was given "for best showing the official test for safety, ease of control,

absence of noise, vibration, heat or odor, cleanliness and excellence of design and workmanship." The carriage which took part in the race presents a handsome appearance, and at first sight it resembles some new kind of surrey. As no machinery is in sight, with the exception of the steering lever, this motor carriage is free from the criticism which is generally passed on horseless carriages, that they look more like a box of machinery than a pleasure vehicle. The other carriage, which is shown in the engraving, seats two, and is what is known as a "Crawford wagon." The wheels of the prize winner are of wood, and are of the usual construction, except that they are fitted with pneumatic tires and ball bearings. The driving or front wheels are 40 inches in diameter, and the rear or steering wheels are 38 inches in diameter. The steering is accomplished by turning the rear wheels parallel with each other from a point about three inches inside of the plane of the wheel, and they are connected by a rod to a vertical lever at convenient height, which is operated from the front seat of the carriage. Although at first sight it might be supposed that steering from the rear might be more difficult than steering from the front, yet, as a matter of fact, it is found not to be the case, as the carriage can be moved in any direction desired with great certainty and can be completely turned around in a circle of 20 feet in diameter. The batteries are furnished by the Electric Storage Battery Company, Philadelphia, Pa., and consist of four sets of twelve cells each, having a normal capacity of 50 ampere hours per cell. They are grouped in boxes and so arranged that they can be readily and quickly pushed in place inside the body of the carriage, all of the connections being made automatically. The carriage is driven by two Lundell motors of nominal one and one-half horse power capacity. Each is attached to the front axle with pinions on the armature shafts, gearing directly into the driving gears attached to the front wheels. The weight complete with the batteries is 1,650 pounds. It is said that on good roads a maximum speed of twenty miles per hour can be obtained. The capacity of the battery is sufficient to run the carriage from twenty-five to thirty miles on one charge. The carriage shown in the engraving is of lighter build.

By far the lightest motorcycle among those which were present at the contest of November last was the gasoline carriage of Max Hertel, of 103 West Monroe Street, Chicago, Ill., as the motorcycle weighs only 220 pounds and seats two people. Although this carriage did not take part in the race, it was awarded a prize by the judges of the Times-Herald motorcycle race of \$100 for a device for starting the motor from the operator's seat in the vehicle.

The vehicle is built on the lines of the bicycle, the frame being constructed of seamless steel tubing and the wheels have tangent spokes, ball bearings and pneumatic tires. The carriage is driven by a double cylinder gasoline motor of special construction, which weighs only 100 pounds and which develops two horse power at full speed. The power from the motor is transmitted to the rear wheels by means of friction gearing, which does away with all belting, chains, and sprocket wheels and insures an easy and almost noiseless running vehicle. The motorcycle is guided and controlled with the aid of two levers. One lever stops and starts the motor, connecting it with the vehicle and disconnecting it, changes the speed and gear and sets the brakes, all with a simple forward and backward motion. The other lever is used to steer the carriage. The reservoir holds enough gasoline for a fifty mile run, and the cost amounts to less than one cent for each five miles traversed on a level road.

The Ames steam carriage was devised by Mr. A. C. Ames, of Chicago. The boiler is of the Scotch type, the heat from the burners passes under the shell of the boiler and passes out by forced draught with the exhaust. The fuel used is gasoline, and the burners are so arranged that one is controlled by the operator, while the other is controlled by the steam pressure or by hand as desired. When the carriage is stopped, the steam pressure rises rapidly and cuts down the flame of the burners, and when the pressure drops the supply of gasoline is again increased. The feed water passes through a heater inside the boiler jacket. The engines are fastened on the lower part of the bicycle frame and are coupled to the treadle shafts by means of crank pins. The engines are of the oscillating type and the diameter of the cylinder is 1¾ in., stroke 13 in. The trunnions are of cast iron. The weight of the entire vehicle when ready for a run is only about 400 pounds.

An Industrial Exposition in Brazil.

An exposition representative of the industries of Brazil is now in progress at the capital, Rio Janeiro. It is said to afford proofs of material progress in manufactures, particularly in the growth of small industries in the different provinces. The Rio News says: "It will be a revelation to many to find that there are so many industrial establishments in the country."

Artificial Monstrosities.

Prof. J. A. Ryder, of Philadelphia, says Dr. Eugene Murray-Aaron in Popular Science News, has recently made research of some length into the methods by which the Japanese have produced the race of double-tailed gold fish, *Carassius auratus*, which are such favorites with fanciers and the owners of aquaria in this country; and, incidentally, he has also called attention to some very interesting facts of a like nature regarding other allied vertebrates. The experiments of Weber, proving that the eggs of the common pike could be caused to produce double monstrosities if the recently fertilized eggs were violently shaken, were the initial discoveries that have led to the present doubling from a single yolk. This fact is known to our fish commissions, and great care must at first be used to prevent the almost entire production of monstrosities by rough handling.

More remarkable still is the conclusion reached by Von Ihering that certain armadillos normally produce several young from a single fertilized egg. Dr. Ryder is inclined to regard the double-tailed gold fish as "the actual realization of an eight-limbed vertebrate," a thing most contradictory of our present basis of animal classification. These fish have been produced in Japan, he concludes, for at least two centuries, and they there command high prices among the wealthy classes, the finest or most abnormal variations being in great demand. By taking the eggs of the normal species of gold fish and shaking them, or disturbing them in some way, the Japanese get double monsters, some with double heads and a single tail, and some with double tails. Naturally the complete double monsters would be unlikely to live, while those with only the duplication of the tail, having the problem of life in no way complicated for them, would be quite likely to survive. These monstrosities, being selected and bred, would in all probability hand onward the tendency to reproduce the double tail, which in time would become fixed and characteristic, if judicious selection were maintained by interested breeders, as has been the case with the many breeds of dogs, horses, fowls and pigeons.

Barfurth, experimenting upon tadpoles, has found that duplication of the tail in them has much to do with the manner in which it is removed. For example, if the tip of the tail were snipped off exactly at right angles to the axis of the body, the tail was regenerated of the normal form and straight backward. If removed at an acute angle, regeneration took place, so that the new tip was directed either upward or downward, according as the inclined, regenerated cut surface looked upward or downward. These facts cannot be dismissed as useless in connection with the problem of inheritance in general; for while, as we rise in the scale of organization, the tendency to regenerate lost parts becomes more restricted, the tendency to produce monstrosities due to disturbances of development remains in full force, as is illustrated by the disposition to reproduce extra toes in the cat, the same tendency hereditary in the Dorking fowl, or even the disposition to reproduce extra thumbs or toes in the human family.

Timber Supports.

The American Association of Railway Superintendents, Bridges and Buildings, says the Architect and Contract Reporter, recently appointed a committee for the purpose of considering the strength of bridge and trestle timbers. The committee came to the following conclusions:

1. Of all structural materials used for bridges and trestles, timber is the most variable as to the properties and strength of different pieces classed as belonging to the same species, hence impossible to establish close and reliable limits of strength for each species.
2. The various names applied to one and the same species in different parts of the country lead to great confusion in classifying or applying results of tests.
3. Variations in strength are generally directly proportional to the density or weight of timber.
4. As a rule, a reduction of moisture is accompanied by an increase in strength; in other words, seasoned lumber is stronger than green lumber.
5. Structures should be, in general, designed for the strength of green or moderately seasoned lumber of average quality, and not for a high grade of well seasoned material.
6. Age or use does not destroy the strength of timber, unless decay or season checking takes place.
7. Timber, unlike materials of a more homogeneous nature, as iron and steel, has no well defined limit of elasticity. As a rule, it can be strained very near to the breaking point without serious injury, which accounts for the continuous use of many timber structures with the material strained far beyond the usually accepted safe limits. On the other hand, sudden and frequently inexplicable failures of individual sticks at very low limits are liable to occur.
8. Knots, even when sound and tight, are one of the most objectionable features of timber, both for beams and struts. The full size tests of every experimenter

have demonstrated not only that beams break at knots, but that invariably timber struts will fail at a knot, or owing to the proximity of a knot, by reducing the effective area of the stick and causing curly and cross grained fibers, thus exploding the old practical view that sound and tight knots are not detrimental to timber in compression.

9. Excepting in top logs of a tree or very small and young timber, the heart wood is, as a rule, not as strong as the material further away from the heart. This becomes more generally apparent in practice in large sticks with considerable heart wood cut from old trees in which the heart has begun to decay or been wind shaken. Beams cut from such material frequently season check along middle of beam and fail by longitudinal shearing.

10. Top logs are not as strong as butt logs, provided the latter have sound timber.

11. The results of compression tests are more uniform and vary less for one species of timber than any other kind of test; hence, if only one kind of test can be made, it would seem that a compressive test will furnish the most reliable comparative results.

12. Long timber columns generally fail by lateral deflection or "buckling" when the length exceeds the least cross sectional dimension of the stick by 20; in other words, the column is longer than 20 diameters. In practice the unit stress for all columns over 15 diameters should be reduced in accordance with the various rules and formulas established for long columns.

13. Uneven end bearings and eccentric loading of columns produce more serious disturbances than usually assumed.

14. The tests of full size long compound columns composed of several sticks bolted and fastened together at intervals show essentially the same ultimate unit resistance for the compound column as each component stick would have if considered as a column by itself.

15. More attention should be given in practice to the proper proportioning of bearing areas; in other words, the compressive bearing resistance of timber with and across grain, especially the latter, owing to the tendency of an excessive crushing stress across grain to indent the timber, thereby destroying the fiber and increasing the liability to speedy decay, especially when exposed to the weather and the continual working produced by moving loads.

Prize Offered for a Fuse Design.

The Verband Deutscher Elektrotechniker is offering a prize, consisting of a diploma and \$75, for the best device by which mistakes, such as placing the wrong size fuse in fuse terminals, and the interchanging of fuses except by authorized persons, shall be rendered impossible. The standard sizes of lead fuses adopted by the Verband at its last annual meeting are to be employed. These, according to the Electrical Engineer, are:

Amperes.	Distance between centers of fuse terminals in inches.	Diameter of terminal screw in inch.
50	2-8	¼
100	3-2	⅜
400	3-8	½
1,000	4-4	¾

The designs are to remain in every respect the property of the individual, and must be sent in not later than April 1, 1896, addressed to the Verband at 3 Monbijouplatz, Berlin, N., and marked with a motto. The result will be made public at the next annual meeting of the Verband.

Blast Furnace Charges as Lightning Conductors.

Repeated instances are said to have been noted in Germany of lightning flashes, instead of being attracted by the lightning conductor on a blast furnace chimney, taking the charge of the chimney itself as a conductor, and passing down through the furnace charge, through the pig bed and into the earth, without doing any damage. It is said that this has occurred several times at one furnace, where a good conductor extends above the top of the chimney, the explanation being that a column of smoke containing much water and carbon dust extended up to a considerable height, and thus furnished a better conductor of electricity to and through the charge itself than was afforded by the outside conductor.

His Collar Exploded.

William Benjamin, a brakeman on the Erie Railroad, caught a spark on the back of his celluloid collar as his train entered the station at Hillsdale, N. J., January 2. The collar took fire and exploded with a loud report. Benjamin seized the collar with both hands and tore it from his neck. He was burned severely on the face, neck and hands. He was taken to a drug store, where his wounds were dressed, and later was taken to his home in New York. He will be disabled for some time.

WILLIAM CROOKES, F.R.S.

The recent remarkable discoveries of Prof. Roentgen when engaged in experimental work with a Crookes tube have brought prominently before the world the name of William Crookes, a name that was already famous in the world of science. There are, indeed, few, if any, among the scientific leaders of the latter half of the nineteenth century who have had a more brilliant and varied career than the author of the vacuum tubes which have made possible the recent startling developments in photography.

He was born in London in 1832, and at an early age turned his attention to photography. After a course at the Royal College of Chemistry under Dr. Hoffman, during which, at the age of 17, he gained the Ashburton scholarship, he became in due time senior assistant to his tutor. His rise was rapid, and at the age of 22 he was appointed superintendent of the meteorological department of the Radcliffe Observatory at Oxford. In 1859 he founded the Chemical News, and five years later he became editor of the Quarterly Journal of Science.

Prof. Crookes had a natural love for original research. In 1861, while examining the residues from a sulphuric acid works, he discovered the new metallic element thallium. This was followed by his election as a fellow of the Royal Society. It was his "delicate spectroscopic investigations" in connection with the newly discovered element "which led him to the study of the 'rare earths,' which has proved so fruitful in his hands."

The mining world is deeply indebted to him for drawing attention to the value of sodium amalgam in the extraction of gold. At a later date he called in the aid of the alternating electric current. This agent, acting in concert with various mercurial salts, and particularly with mercury cyanide, has rendered possible the extraction of gold from highly refractory ores.

In 1872 he was at work on his investigations on "Repulsion Resulting from Radiation," to which question his attention had been drawn by his observing the action of heavy pieces of glass which he was weighing in a vacuum balance, which, by the way, was his own invention. In 1877 he invented the otheoscope; and in the same year Science signified its indebtedness to him by electing him a member of the Royal Society. In a paper before the society he stated that he had "succeeded in obtaining a vacuum so nearly approaching perfection that the pressure in it was only 0.4 millionth of an atmosphere." These experiments led to very important results; for it was found that in such an extreme vacuum gases pass into an ultra-gaseous state, which Prof. Crookes termed a state of "radiant matter;" and further, these extreme vacua opened up the way for the incandescent lamp.

A March number of the Electrician of 1891 says: "Professor Crookes' house in Kensington Park Gardens, electrically lighted in 1881, was, we believe, the first house in London fitted up with the electric light. It may be interesting to state that the wires were chiefly laid with his own hands. To meet the difficulty of obtaining carbon filaments for the glow lamps, not possessing the structure of the material from which they were made, Prof. Crookes dissolved cellulose in a strong solution of ammonium copper sulphate, dried up the solution into sheets, dissolved out the copper, and used the horn-like material

remaining for filaments. The lamps in the inventor's house, fitted with such filaments, remain still in good working condition."

In 1880, the French Academy of Sciences conferred upon Prof. Crookes an extraordinary prize of 3,000 francs and a gold medal, in appreciation of his researches in molecular physics and on radiant matter.

His studies of the "rare earths" have led Prof. Crookes to the conclusion that "the bodies which have generally been accepted as elements are not pri-



Sincerely yours
William Crookes

mordially distinct or independent, but have been formed by a process of evolution remotely analogous to that which we now recognize as having been at work in the formation of organic species." These views were put forth in his presidential address before the chemical section of the British Association, under the title "The Genesis of Elements;" and it is undoubtedly his most splendid among many brilliant contributions to the philosophy of science. In 1885 the So-

ciety of Arts, and in 1888 the Royal Society, gave him medals, the first "for his improvement in apparatus for the production of high vacua and for his invention of the radiometer," and the latter society "for his investigations on the behavior of substances under the influence of the electric discharge in a high vacuum."

In addition to his extensive work in the laboratory, Prof. Crookes has been a voluminous contributor to the scientific literature of the age. Among other works he has written "A Handbook of Dyeing and Calico Printing," "Select Methods in Chemical Analysis," a manual of "Dyeing and Tissue Printing," a work on "The Solution of the Sewage Question." He has translated and edited Reimann's "Aniline and its Derivatives," Wagner's great work on "Chemical Technology," and many other works of scientific prominence have emanated from his busy pen.

The splendid results which have attended Prof. Crookes' labors are not to be attributed solely to his undoubted genius for experiment and observation. They are largely the result of persistent hard work carried out on logical lines and with strict attention to method. He possesses that "infinite capacity for taking pains" which is indispensable to genius, if its powers are to produce valuable, lasting results.

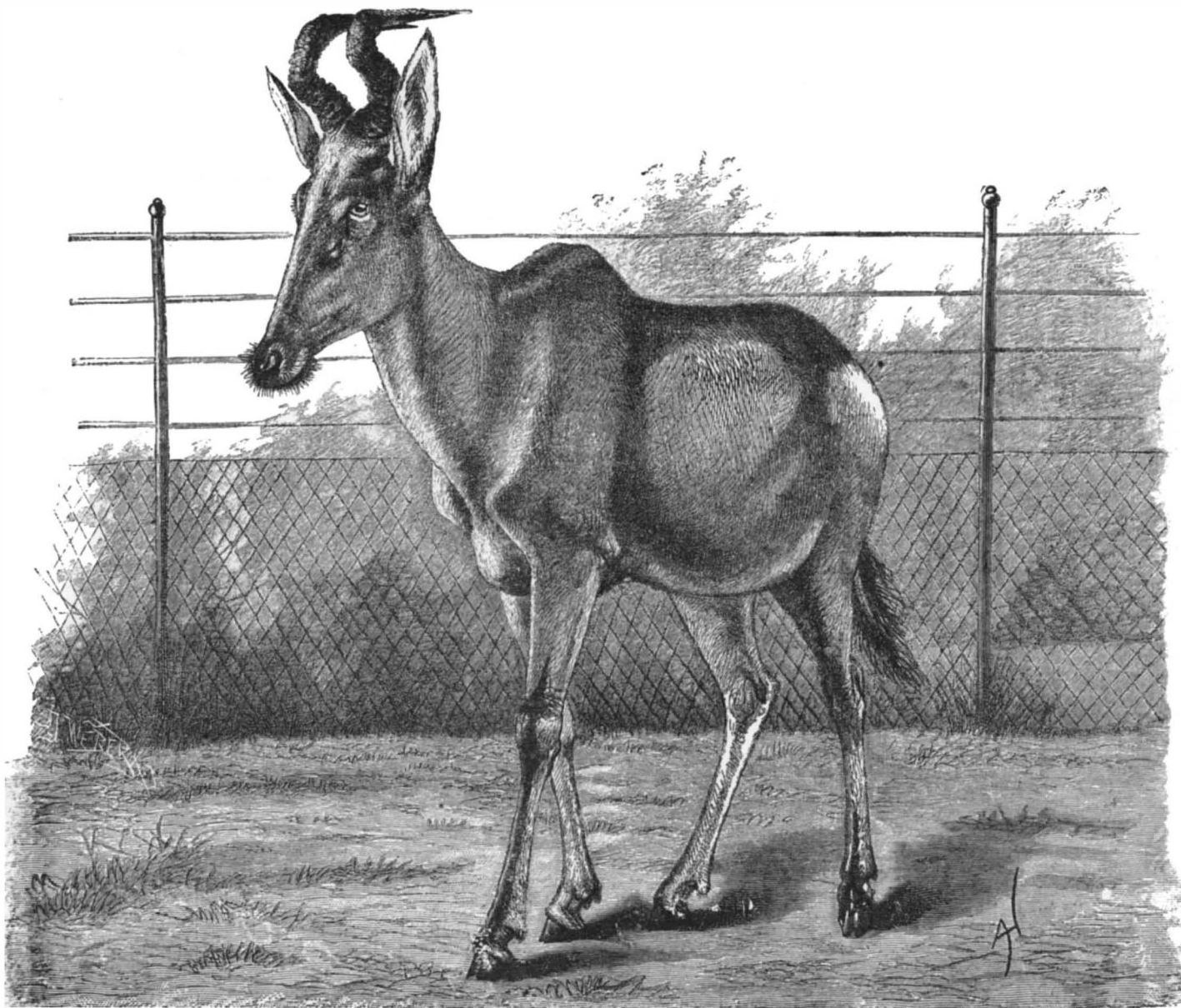
A COMPANY is being formed, it is announced, to work a coalfield at Astley, in Warwickshire, where, it is stated, the principal seams are over 20 feet in thickness, and are not deeper than 500 yards. The English Mechanic thinks it rather strange that a field so rich and so near London has not been worked before.

THE KONZI ANTELOPE IN THE BERLIN ZOOLOGICAL GARDEN.

For many years past antelopes of certain species have been a familiar sight in the zoological gardens, but explorers knew that there were many other species on the steppes of Eastern Africa that had never been exported. One of the most interesting of these is the konzi antelope, only one living specimen of which has been taken to Europe, and that is now in the Berlin Zoological Garden. Our engraving (for which we are indebted to the Illustrirte Zeitung) is taken from a drawing of this animal made by Anna Held. These antelopes graze in small herds on the grass-covered steppes while an old bull keeps watch from a neighboring eminence. They prefer places where fresh, new grass has started after the old grass has been burned over, but a short time spent in such a locality makes quite a change in their appearance. They are naturally of a golden brown color, so near the color of the ground on which they graze that it is difficult to distinguish them from a distance, but after grazing in

one of these burned districts they have black spots on their shoulders that might easily lead a naturalist to suppose they belonged to a different species from those that had grazed where there had been no fire. These spots are caused by rubbing their shoulders against charred trees, the black being retained by the oily secretion of the lachrymal glands. The only natural black marks are those on the legs.

DECEMBER fires in the United States and Canada caused a loss of about \$10,000,000, and the milling and allied industries contributed about \$410,000. The total loss for 1895 is \$130,000,000, against \$128,000,000 in 1894 and \$157,000,000 in 1893.



THE KONZI ANTELOPE.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ENGINE.—William F. and Eugene W. Cleveland, Rounthwaite, Canada. To prevent all possible back pressure, by affording a full and complete exhaust, thus utilizing the steam to its utmost efficiency, these inventors provide a hollow piston connected at all times with the exhaust, while valves mounted on the heads or faces of the piston alternately connect its interior with the ends of the cylinder.

Railway Appliances.

CAR FENDER—Michael F. Flynn, Stamford, Conn. This fender is normally carried in substantially vertical position in front of the dash board, but has a lower front cushioned roller adapted to strike and trip one caught in the path of a moving car, in which case the lower portion of the fender is automatically moved out to present a bed to receive the falling body. Simultaneously with this action a cable attached to the brake and another connected with the trolley arm are operated to apply the brakes and break the electric connection supplying power, or to release the grip in case the car is moved by cable.

AUTOMATIC REPEATING SIGNAL.—Robert H. Innes, San Antonio, Texas. This is an apparatus for use in connection with semaphore and other train signals to prevent mistakes when notifying the central official, and automatically report changes in the position or color of the signal to a central office over the ordinary telegraph wire. A wheel operates a key to send a message that the signal is changed to "danger," and the turning of the wheel engages the signal repeating device, so that when the latter is actuated to clear the signal a second message is sent to the central office to that effect.

Electrical.

ELECTRIC RAILWAY SYSTEM.—John F. Page, Chewacla, Ala. This is an improvement in systems where the main line conductor is underground, and has feeders, each consisting of a normally open partial circuit leading to a contact rail or plate, and having a circuit closing device. An endless driven cable carried on the car is arranged to contact with the contact rails or plates in the conduit, transmitting the current through the cable to the motor circuit, and improvements are introduced in the circuit closing devices to be actuated by the endless cable, the improved system being designed to be more safe and efficient than systems heretofore in use.

Mechanical.

TONGS.—John Quinn and William H. Bradley, Mingo Junction, Ohio. These tongs may be readily opened and closed or moved about, a uniform power being obtained for their opening and closing, while they securely hold or release the article. On one of the tong arms is a rock bar engaging a pinion on the other tong arm, there being a rein or handle for turning the pinion.

METALLIC PACKING.—Edward L. Raynsford, Susquehanna, Pa. This is an improvement on a formerly patented invention of the same inventor, providing a packing for use on piston rods, balance slide valves, etc., without the use of springs or glands, and consisting principally of a ring having an annular groove with outwardly beveled sides and a second ring with inwardly beveled sides fitting in the groove of the first ring. For balance slide valves the packing is made in straight form.

Miscellaneous.

BICYCLE SUNSHADE.—John Murgatroyd, New York City. By means of clips this sunshade may be connected to the frame of a bicycle and adjusted at any inclination desired, and there are mounted at the upper end of the staff ribs and braces of peculiar construction, whereby the forward ribs may be shortened and the rear ribs lengthened, to afford a shade with rearward extension that will offer but little resistance to the wind, the cloth being effectively prevented from tearing by the operation of the bows and braces.

BLOOMERS.—Thomas H. Royce, Brooklyn, N. Y. This invention is for a garment formed of two duplicate patterns or cuts designed to produce a graceful fullness at the lower portion of the bloomers, and cause them to appear as nearly like a skirt as possible.

RACE TRACK STARTER'S GATE.—Patrick Ryan, New York City. For stopping the horses where a false start has been made for a race, this invention provides near the head of the race track, a pliable gate having hanger arms pivoted on posts, springs pressing the arms and gate normally upward, and a latching device holding the gate down, while a releasing mechanism may be operated by the starter. When the horses have made a good start, the starter shifts a lever which releases the gate, when it rises to clear the track, but the gate is allowed to remain down when a false start has been made.

DUPLICATE WHIST BOARD.—Lucius C. Thompson, Rolfe, Pa. This invention provides means for attaching counters to the board, and also for holding cards in place on the board, the latter being so made that auxiliary counters may be placed on it without confusing the regular counters. The corners at opposite sides of the board are of different arrangement, to provide for a proper location of the board in original and duplicate.

MUSIC LEAF TURNER.—Peter H. Adams, Osorno, Chile. This device comprises a casing in which revolves a cylinder having projecting pins adapted to engage levers, the latter engaging a second series of spring actuated levers or arms whereby the leaves of sheet music may be successively turned, the casing being placed upon a piano with the leaves of music engaged by the arms, when each leaf is turned as the performer strikes a lever at one side.

PHOTOGRAPHER'S DARK ROOM.—Ferdinand A. Wattenberg, New York City. This is a portable apparatus, which may be readily folded up for transportation or storage, and when opened out and set up enables the user to develop sensitive plates, and fill holders and cameras, etc. It is made of flexible material to inclose the upper part of the body in one end, while in the end piece at the other end is a ruby glass window, and the bottom is formed with pipes or tubes which permit the entrance of air.

LAMP.—Jacob Weintraub, New York City. This invention relates especially to alcohol lamps, for which a cap or cover is provided to increase, diminish or extinguish the flame, the cap being operated from the exterior of the lamp. The horizontal combustion surface has a ring-shaped cover, the opening of which is regulated by segmental plates having pivotal connection at one end with the cover, in which is supported a ring having radial slots into which projections from the plates extend, there being on the ring a rack engaged by a pinion whose shaft extends outwardly and terminates in a hand wheel.

WATER COOLER AND FILTER.—Henry Roeske, Philadelphia, Pa. With this apparatus filtered water may be drawn directly from the water supply pipes or from the cooler, as desired, and the filtering material is designed to be impregnated with a mineral salt, as borax, or with salicylic acid, to temporarily prevent or arrest fermentation of impurities not removed by mechanical filtration. The filter occupies the bottom portion of a cylindrical tank in which is an ice surrounded receiving vessel connected with the water supply, the overflow of this vessel passing down through a central tube to the filter bed, while the water supply is also directly connected by another pipe with the central tube.

FENCE WIRE FASTENER.—Reuben E. Curtice, Spencer, Ohio. In wire fences where the wires are kept parallel by upright stay rods, this improvement provides readily applicable novel spring clasps to retain the stay rods in position, and permit their ready removal when desired. The clasp consists of a wire bent upon itself to form a loop and two parallel members, both of which are bent to form U-shaped loops, both the stay rods and the wire being embraced by the loops.

WIRE FENCE MACHINE.—Zachariah R. Kling, Laclede, Mo. Where wire fences are made up of palings or pickets and posts, the wires being attached to the posts and looped around the palings, this improvement provides a simple device whereby two or more wires may be readily twisted to hold between them a paling, the wires being at the same time stretched, and the stretching device being temporarily attached to the post over which the wires may be drawn. The wires are held parallel and taut by a clamping mechanism, some distance in advance of a twisting mechanism, through which the wires pass, being twisted by the turning of a crank as each picket is placed in position.

ROAD RAKE.—Albert Daggett, Strong, Me. This improvement comprises a vehicle from which is suspended a V-shaped rake, with its point forward, a lever mechanism being adapted to raise either side of the rake independently, and springs being arranged to press against the upper surface of the rake back. It is a simple machine for use on country or unpaved roads, being adapted to sweep away all loose stones, etc., without disturbing the roadbed or gravel, while also leveling the road by breaking up dried mud.

REIN HOLDER.—Granville Bartlett, Rushville, Ind. This holder is formed of wire, with side lengths adjusted on opposite sides of the dashboard, the wire having finger-hold loops and crimped holding portions, having a strong downward tension. By means of the finger holds the holder may be lifted to pass the reins between it and the dashboard, where they will be held by the tension of the holder.

SPOKE SOCKET.—Samuel S. Sheaffer, Veedersburg, Ind. An improved spoke adjuster and clip, by means of which the tires of a wheel can be readily and quickly tightened, is provided by this invention, comprising a socket to fit on the spoke, there being in the upper end of the socket a bolt having a conical upper end, while a clip fitting upon the felly has a socket to receive the conical end of the bolt. The device may be readily applied to old wheels whose tires have become loose as well as to new ones.

CHEESE CUTTER.—Nicholls J. Smith, Waycross, Ga. This is a simple mechanism by means of which cheese may be cut into slices of any desired weight, an indicator plate marking the width of cut necessary for a slice of the weight sought. The cheese is supported upon a revolving table, and a center rod projecting upward through the cheese forms a guide for the rear end of a vertically moving knife or cutter actuated by a rack bar by rotating a hand shaft. A graduated gage plate is adjustably supported above the cheese from a collar clamped to the center rod.

BOTTLE FILLING DEVICE.—James Ireland, Toronto, Canada. This is a simple and inexpensive device designed to be directly applied to a can or other receptacle, and having branching tubes each connecting with a single bottle, a valve opening or closing all the tubes simultaneously. In connection with the filling device, a tray is arranged to hold the bottles stationary when beneath the filling tubes.

COLLAR BUTTON.—Ferdinand A. Wattenberg, New York City. This button has the usual base, shank and head, but in the front of the head is a recess and an upwardly opening spring pressed hinged plate, on the back of which are prongs, which project downward when the plate is opened and swung up. The plate is closed when the button is placed in the neck band and the collar buttoned over it, but before tying the scarf the plate is swung upward, when its prongs hold the tie in position and prevent it from slipping upward or sidewise.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE INTELLECTUAL RISE IN ELECTRICITY. A History. By Park Benjamin, Ph.D., LL.B. New York: D. Appleton & Company. 1895. Pp. xi, 611. Price \$4.

Dr. Benjamin's work on the early history of electricity contains, naturally, a quantity of interesting matter. It deals with the work of the early philosophers. Of course, the exact status of intellectual progress in the olden times is very difficult to get at, it being certain that, in our inability to get below the surface, we often misjudge the motives which actuated the people of past centuries. In Dr. Benjamin's book considerable readiness to criticize unfavorably these people of the past is shown, and the work cannot, we think, be accepted as a reliable exponent of the real intellectual life of the ages of which it treats, it being questionable if data enough exist for obtaining a true idea of those days. In other words, Dr. Benjamin's views seem to us to be decidedly one-sided, and he never hesitates to give his personal view of matters hardly appertaining to science.

LECTURE NOTES ON THEORETICAL CHEMISTRY. By Ferdinand G. Wiechmann. Second edition. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1895. Pp. xviii, 283. Price \$2.50.

Dr. Wiechmann's work, now before us, attempts to review to an adequate extent the subjects of chemical physics, stoichiometry and chemical energy, thus giving a philosophical view of the entire theory on which modern chemistry is based, not touching upon chemistry pure and simple as such. The advanced chemist will find in it much to interest him, notably in the treatises on chemical notation and on the molecular theory. An excellent index of subjects, with a supplementary index of names and an adequate table of contents, are features of the book which still further commend it to us. It will be found an excellent work to remove from chemistry the dry aspect of a mere collection of facts, as it systematizes and puts the whole into concrete form.

THE ELECTRICAL TRANSMISSION OF ENERGY. A Manual for the Design of Electrical Circuits. By Arthur Vaughan Abbott, C.E. With nine folding plates. New York: D. Van Nostrand Company. London: Sampson Low, Marston & Company, Limited. 1895. Pp. xiv, 586. Price \$4.50.

There is no question that the transmission of energy is now one of the most important functions of electricity. This excellent work, liberally illustrated, with excellent table of contents, list of plates and satisfactory index, is to be strongly commended as a valuable addition to technical literature in the larger field of electrical engineering. Its very numerous illustrations and diagrams alone almost suffice to tell its story, and we are glad to be able to commend it to the electric profession. It seems thoroughly up to date, something which it is very difficult to obtain in a work on electricity, but this one really seems adequate. The author, however, in one of his statements—that referring to electrolysis of water pipes—seems confused or unwilling to state the real cure for this evil, which he implies is "a metallic return circuit which shall be amply sufficient to convey to the power house all the energy required to operate the railway system." The real cure is, of course, to have the entire power circuit absolutely insulated from the ground.

DESCRIPTIVE CATALOGUE OF ESSENTIAL OILS AND ORGANIC CHEMICAL PREPARATIONS. Compiled by Frederick B. Power, Ph.G., Ph.D. New York and Garfield, N. J.: Fritzsche Brothers, branch of Schimmel & Company, Leipsic and Prague. Pp. v, 96. Price \$1.

THE JUCKLINS. A novel. By Opie Read. Chicago: Laird & Lee. 1896. Pp. 291, 12mo. Illustrated, cloth, gilt top. Price \$1.

The Horseless Age, a monthly journal devoted to the interests of the motor vehicle industry, is published by E. P. Ingersoll, 157 and 159 William Street, New York City. The subscription price is \$2 a year.

The Motorcycle is published in Chicago, Ill., by the Motorcycle Publishing Company. Price for the United States and Canada is \$1 per year. Both of the above publications are liberally illustrated with engravings of the latest motorcycles, etc.

Terrestrial Magnetism.—An international quarterly journal, published under the auspices of the Ryerson Physical Laboratory of the University of Chicago. It is edited by L. A. Bauer, with the co-operation of such well known scientists as C. Abbe, W. Von Bezold, T. C. Mendenhall and a number of others. The subscription price is \$2 a year; the first number contains an article on electric currents induced by rotating magnets and their application to some phenomena of terrestrial magnetism, Halley's earliest equal variation chart, reproduced in fac-simile for the first time from a photograph furnished by the possessor of the chart. The rest of the periodical is made up of letters to the editor, etc.

The Digest of Physical Tests and Laboratory Practice is published quarterly, by Frederick A. Riehle, Philadelphia. This is a resume of practical tests made in the laboratories of the world. The subscription price is \$1 per year. The present number gives an account of testing various engineering materials, such as cements, beams, cast iron car wheels and tests of iron, steel, tests of signal pipe connections, etc. The new publication is freely illustrated.

Good City Government Conferences form the subject of a 500 page octavo published by the National Municipal League, of Philadelphia. It includes the proceedings of the Second National Conference for Good City Government, at Minneapolis, in December, 1894, the first annual meeting of the National Municipal League, and a third national conference at Cleveland in May, 1895.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.
"C. S." metal polish. Indianapolis. Samples free.
Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.
For bridge erecting engines. J. S. Mundy, Newark, N. J.
Handle & Spoke Mch. Ober Lathe Co., Chagrin Falls, O.
Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.
Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.
For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.
'The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, \$4; Munn & Co., publishers, 361 Broadway, N. Y.
Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6718) J. H. F. says: Will you please give me a formula for making inking rollers for hand printing presses? A.

Best glue..... 10½ lb.
Black molasses or honey..... 2½ gal.
India rubber, dissolved in oil of turpentine..... 1 lb.
Venice turpentine..... 2 oz.
Glycerine..... 12 oz.
Vinegar..... 4 oz.

The above formula is given for the mysterious black composition, so durable and elastic, and known but to very few persons until recently. Purified India rubber only is used. To recast add 20 per cent new material. The old home receipt is, 2 lb. best glue, soaked over night, to 1 gal. New Orleans molasses. Will not recast.

(6719) B. P. asks: 1. Will it seriously interfere with the efficiency of a storage battery to have the area of the negative plate somewhat less than that of the positive? A. No. 2. How can I tell a charged cell from a discharged one? A. By the liquid giving off gas "boiling;" by the color of the positive plate—this is dark red at starting and becomes in the charged cell nearly black; by the specific gravity of solution. 3. Is there any danger of over-charging a cell? A. There is no great harm to be anticipated; it is wasteful of course and gets sulphuric acid into the air and on the connections and so does injury by impairing insulation. 4. What harm is done if the charging current is of too high a voltage? A. None in itself; you simply want to keep a proper amperage. Of course too high a voltage between the cell terminals might give a dangerous amperage. 5. What is a carburetor? A. An apparatus for charging a gas with hydrocarbon vapors. 6. How is petroleum vaporized in petroleum engines? A. It is atomized or blown into fine spray unless volatile enough to form a true vapor. 7. Have you any SUPPLEMENTS on petroleum and gasoline engines? A. We refer to our SUPPLEMENT, Nos. 535, 618, 715, 716, 993, 963, and 1024, price 10 cents each by mail.

(6720) W. S. P. asks: 1. "Experimental Science," page 308, says the Smee battery has an E.M.F. of 1.09 volts when not in action and 0.482 when in action. I don't understand why a cell has any E.M.F. when not in action. Please explain. A. A battery by chemical action maintains a potential difference or E.M.F. between its terminals. When on open circuit or not in action this E.M.F. is greatest; when on closed circuit the E.M.F. generally is reduced. The condition on open circuit is comparable to that of a charged Leyden jar; on closed circuit the condition is comparable to that of a jar kept excited while constantly discharging. 2. Is electrical force wasted when sent through a rheostat, i. e., isn't there more economy to use less cells when possible than to use a rheostat? A. Yes, in general terms rheostats are wasteful and their use is to be avoided if possible. 3. In running a small motor which would be the handler and cheaper, an 8 cell Edison-Lalande primary battery type W or a No. 413 chloride accumulator (storage) where it would have to be sent 12 miles for charging at a light station? The first cost of each is nearly the same. A. Probably the storage cell would be best, but no exact estimate of the relative cost can be given from your data. 4. Would the Gramme ring motor, nicely made, as given in SUPPLEMENT, No. 783, develop power enough to run a dental engine if it had battery power sufficient? A. Yes. 5. How large a 4 blade fan would it drive at 2,000 revolutions per minute? A. A twelve inch fan. 6. Does any SUPPLEMENT describe a motor fully that is between the one in SUPPLEMENT, No. 783, and SUPPLEMENT, No. 641, I mean in size? A. We suggest our SUPPLEMENT, Nos. 759, 761,

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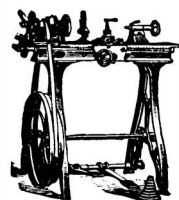
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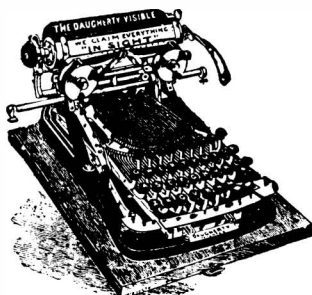
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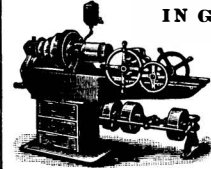
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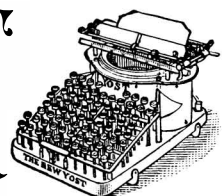
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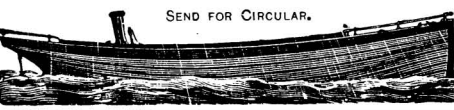
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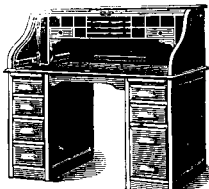
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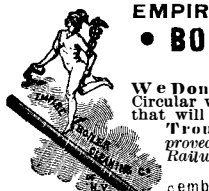
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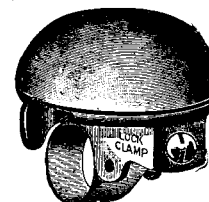
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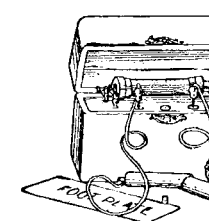
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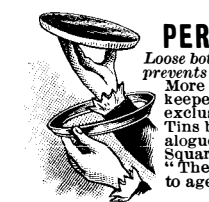


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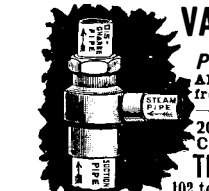
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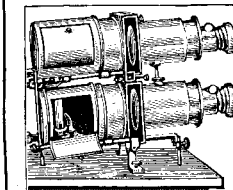
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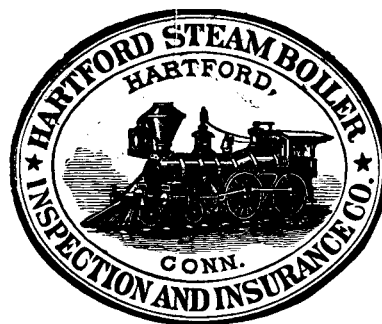
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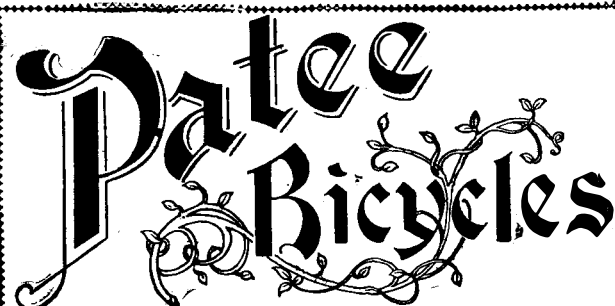


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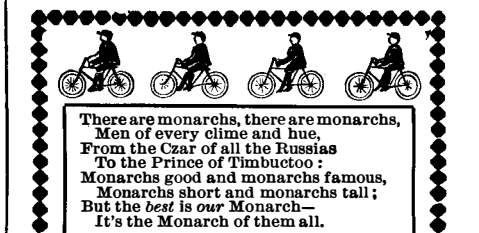


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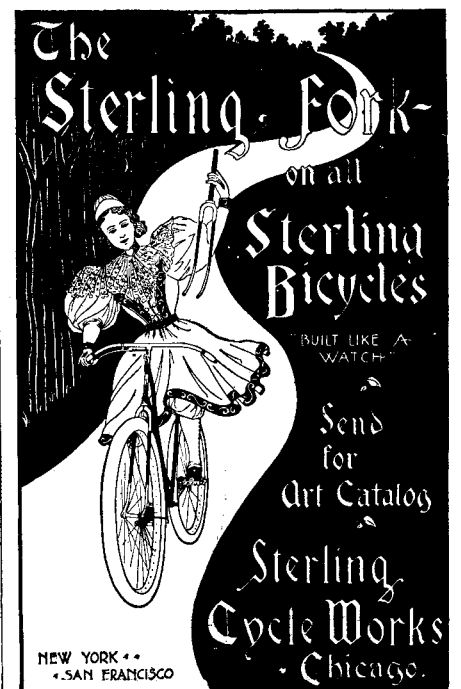
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